The Electrical Industry's Weekly Magazine

March 4, 1957

Electrical World

Price 35 Cents

A McGraw-Hill Publication

Twin Cities Substations Look Like Homes

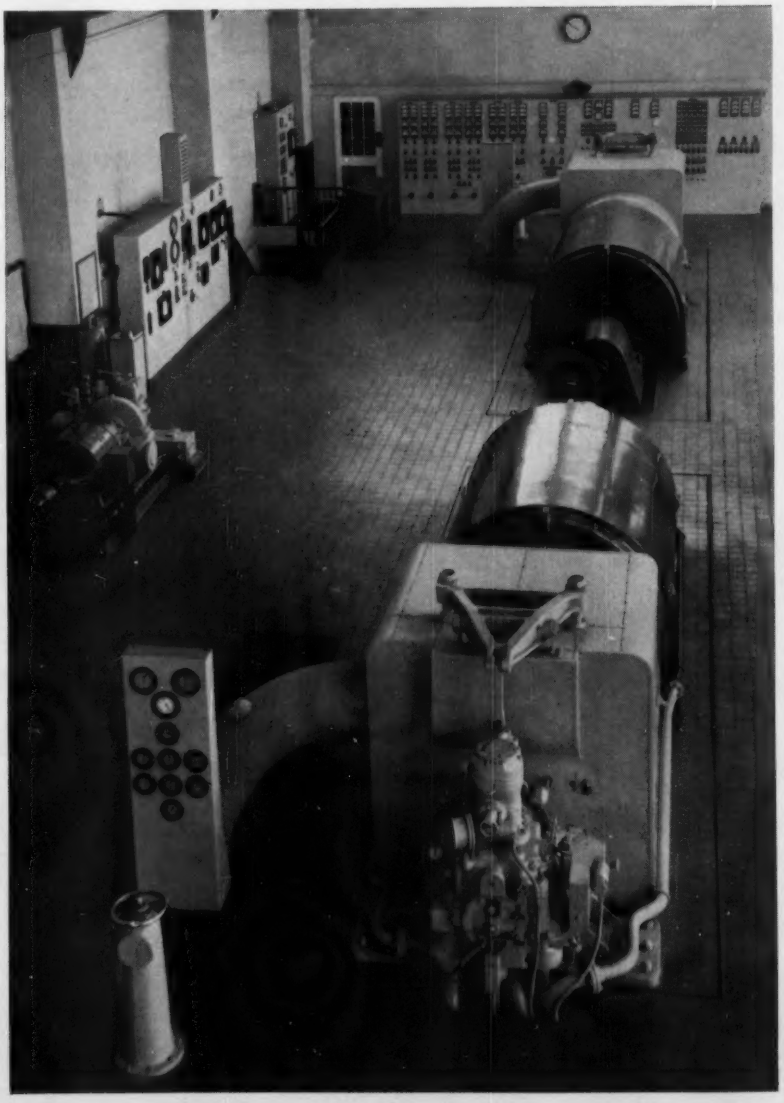
Page 64

Exclusive Interview:

What's Ahead for TVA? . . . Page 51

E B POWER GS W 12
UNIVERSITY MICROFILMS IN
313 N 1 ST
ANN ARBOR MICH

THE CLEAN LIFE IS A LONG LIFE



Dependable operation is a must for turbines. *Texaco Regal Oils R & O* provide protection against rust, foam, and oxidation. What's more, this protection lasts throughout the extra-long life of the oil. Utilities have reported trouble-free service of 30 years and more from Texaco-lubricated turbines.

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TUNE IN . . . METROPOLITAN OPERA RADIO BROADCASTS EVERY SATURDAY AFTERNOON

Electrical World

Vol. 147, No. 9 MARCH 4, 1957

Published for 83 years for those engaged in the business of generating, transmitting, distributing, or applying electric power

Features

CURRENT EVENTS

Interview: What's Ahead for TVA?
Chairman Herbert D. Vogel tells revenue bond financing plans, invites utility executives to exchange data.....p 51

National Electrical Week Scores Hit
In second year this industrywide event reflects refinements, gets more attention, packs bigger wallop.....p 54

MANAGEMENT

Editor Gains Guide for House Organ
Editor of Appalachian Electric Power newspaper uses survey of employees to program his editorial policy.....p 60

DISTRIBUTION

Shield Cuts Lightning Outages 10 to 1
Consumers Power Co's 46-kv wood-pole lines are shielded to take full advantage of the impulse strength of wood...p 61

Capacitor Fusing Has 5 Functions
Isolates, clears, signalizes faulted units, and allows manual switching and unfaulted units to give rated kvar.....p 67

Shopping Centers Desirable Loads
Size, load density, reliability-needs resemble those of downtown commercial areas, characteristics study shows..p 71

SUBSTATIONS

Twin Cities Substations Look Like Homes
Architects help design functional buildings that please the eye and have that lived-in appearance.....p 64

Departments

Atomic Progress 50
Catalogs and Bulletins 104
Editorials 49
• Electrical Newsletter 19
From the Publisher 5
How To 77
• Management Newsletter 113
Manufacturers and Markets 109
Meetings Calendar 106
Meeting Reports 59
New Equipment 97
News About People 120
News-Beat 57
Readers Forum 118
Selling 90
Washington Comment 56

INDEX TO ADVERTISERS.....131

Hearken to this woeful fable of the man who bought a "bargain" cable

A. C. Current, a budding E. E.
Bought cables from many a source
But he didn't take time to consider, you see
That some last longer than others, of course

For some circuits *any* insulation will do—
For others, just one type is proper
But Okonite he never consulted, we rue,
As to which one should cover his copper.

It seems Mr. Current mistakenly thought
(Indeed, 'twas a total delusion)
That Okonite cable would cost him a lot
Whether made by strip, tape, dip or extrusion

Only Okonite insulates cables *all* ways
So our prices are not always highest
And thus when you ask us what cable to use
Our recommendation's unbiased.

The price *does* differ, depending on methods
(The type insulation and how it's applied)
The proof of the pie is in service records . . .
Which we would have gladly supplied.

But A. C., in order to make things look good
Chose a cable he thought was a "buy"
It lasted, we hear, no more than a year,
Then blew him and his factory sky-high.

We hate to relate this horrible fable
But here is a moral for all:
If you should desire a superior cable
By extrusion or strip . . . by taping or dip
Just write us a letter, or call.

No matter *what* insulation or method of application you want (and we use them all) you'll get the best of its kind from Okonite. For a frank, down-to-earth discussion on cable insulating methods, write for Bulletin EW-1106, The Okonite Company, Passaic, N. J.

where there's electrical power . . . there's **OKONITE CABLE**

4827

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. . . from the publisher

"This is one of the toughest pages in the whole book to write. I hope to heck somebody reads it."

So commented a member of our engineering staff the other day as he settled down to compile Electrical World's weekly Engineering Trends page. Happily, his work isn't in vain. Readership studies show this department to be consistently one of our best-read features—and the one most folks write in about, too.

Once titled, "Technical Notes," the new Engineering Trends offers all the features of the old "Notes" column plus more. First, it's been expanded to a full page every week in answer to readers' requests. Second, it attempts to interpret the significance of new trends as well as to report them. And third, it now includes short news items about engineering problems and how they're being solved.

Trends cover a variety of subjects—everything from how to weld twisted joints in aluminum wire to using liquid metal in a steam plant's reheat cycle. Some are advance information on full-length stories yet to appear. Others are simply important bits that may never appear as a story. But every one of them is an idea someone somewhere can put to work in his job.

Turn to Engineering Trends on page 22. If you have an item of interest, we welcome your writing us about it.

Fischer Black

ELECTRICAL WORLD

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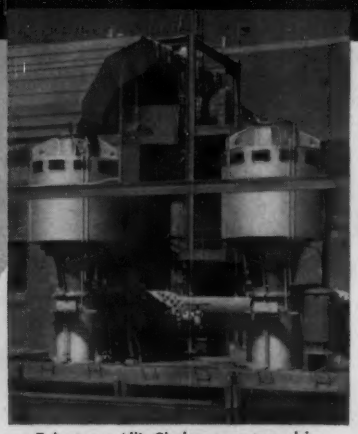
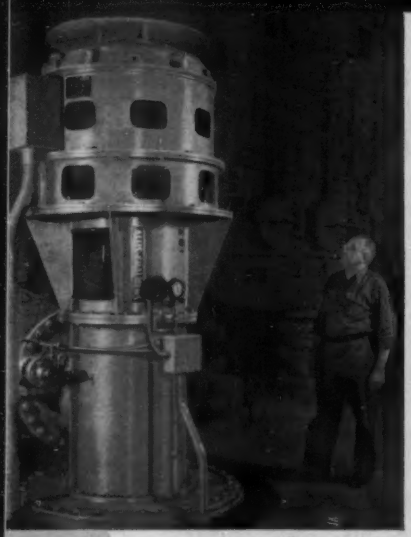
condensing equipment...

Get the whole



Tube-type Allis-Chalmers motors driving condenser cooling water pump.



Vertical mixed-flow circulating water pump and motor.

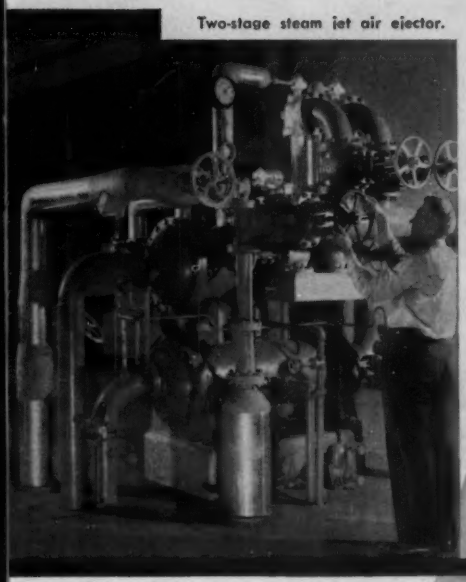
Typical large condenser being aligned in shop prior to shipment.

Two-stage rotary vacuum pump.

Condensate pumps and motors.

"ball of wax"

from Allis-Chalmers



Two-stage steam jet air ejector.

You get all that "unit responsibility" implies in coordination of original engineering, ordering, and installation with Allis-Chalmers condensing equipment.

For A-C builds the condenser with its auxiliary apparatus, including pumps, motors, air removal equipment, switchgear, etc. Moreover, the experience in building millions of square feet of condensers of every size, shape and type enables Allis-Chalmers to meet your special conditions with a high efficiency, high vacuum installation.

for information about Allis-Chalmers condensing equipment, call your nearby A-C office, or write Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wis.

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Includes only *new* stations on *new* sites placed in operation since JANUARY 1, 1950.

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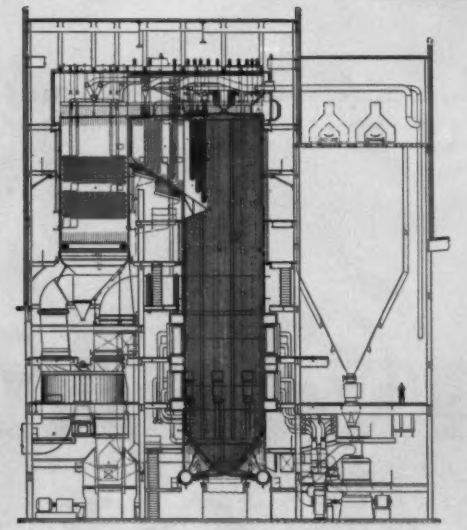

THE C-E UNIT SHOWN AT LEFT is now in service at the Dean H. Mitchell Station. Second and third units of the same design have been ordered. This boiler is of the controlled circulation, radiant reheat type with a divided furnace arrangement. The reheater section is located between the primary and secondary superheater surfaces and an economizer section is located below the rear superheater surface. Regenerative type air heaters follow the economizer surface. The unit is designed to serve a 138,100 kw turbine-generator operating at a throttle pressure of 1800 psig with a primary steam temperature of 1000 F, reheated to 1000 F. Pulverized coal firing is employed, using bowl mills and tilting, tangential burners. Natural gas can also be used and provision is made for future use of oil if desired.

The Dean H. Mitchell Station joined the Northern Indiana Public Service Company's system in December, 1956, when Unit No. 4 (first in this station) was placed in service. By 1959 the plant is scheduled to have 3 units in operation and will add 390,000 kw to the system's total capacity. It will represent the largest single power source in the company's network. Sargent and Lundy, Inc., are the consulting engineers.

Situated in Gary, Indiana, the Dean Mitchell Station helps to serve an area of 12,000 square miles in which residential demand and the needs of steel and heavy manufacturing industries have grown at a rapid rate . . . and show promise of even faster growth in the future. An increase of 90% in system load is projected for the period from 1951 to 1959. The Mitchell plant will supply this increase. And the plant-site anticipates further expansion. It may eventually accommodate three additional units.

Unit No. 4 and the two units now on order are of identical design. Each turbine-generator will be served by a C-E Controlled Circulation Boiler of the Radiant Reheat type. A cross-sectional elevation and a brief description of this boiler appear on the opposite page.

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Combustion Engineering Building
200 Madison Avenue, New York 16, N. Y.

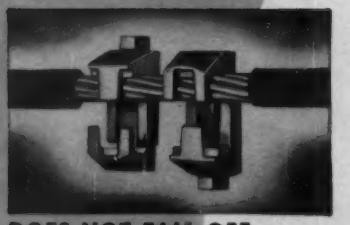
B-983

C-E

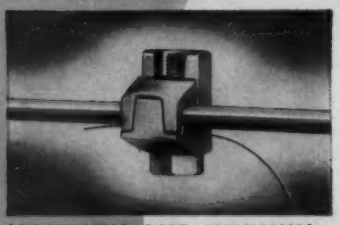
STEAM GENERATING UNITS; NUCLEAR REACTORS; PAPER MILL EQUIPMENT;
PULVERIZERS; FLASH DRYING SYSTEMS; PRESSURE VESSELS; SOIL PIPE

Easier to Install ··

PENN-UNION



DOES NOT FALL OFF
either way it's put on the run.

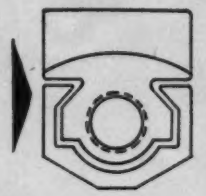


MAXIMUM AND MINIMUM
gripped with full compression.

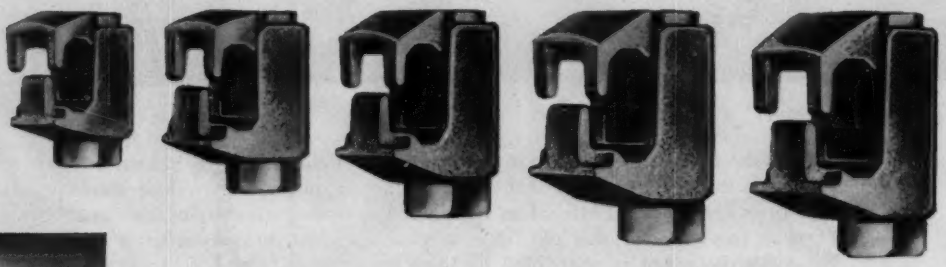
Designed Right for Hot-Line work — every lineman will appreciate these features:

Bolt up or bolt down — it stays on the line. Just hook it over the run, and leave it that way until the tap is inserted and the joint completed — the Penn-Union Vise-Grip won't fall off. *Interlocking fingers* make it self-supporting during installation — and that's important in hot-line work. When the bolt is finger free, there's overlap with two maximum conductors in place.

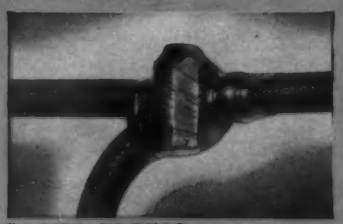
Non-Swiveling — the slide can't rotate. The Penn-Union Vise-Grip can be assembled directly to two maximum conductors with no danger whatever of the slide camming over and rotating out of the body.



Full Compression with Max-Min: Every size Penn-Union Vise-Grip takes two maximum conductors — or one maximum and any smaller conductor down to *minimum* — with *full compression*.



ONE-PIECE,
installed without dis-assembling.



EASIER TAPING
with the Penn-Union Vise-Grip's rounded contours — it's faster, neater, and takes less tape.

10 Sizes...a COMPLETE range,

so that you can buy the right size Vise-Grip instead of a larger one than needed . . . a worth while economy when you use large quantities.

Only 2 Bolt-Head Sizes for the entire line of 10 Penn-Union Vise-Grips, 3/8 inch and 9/16 inch. Just one wrench for 8 of the sizes.

PENN-UNION

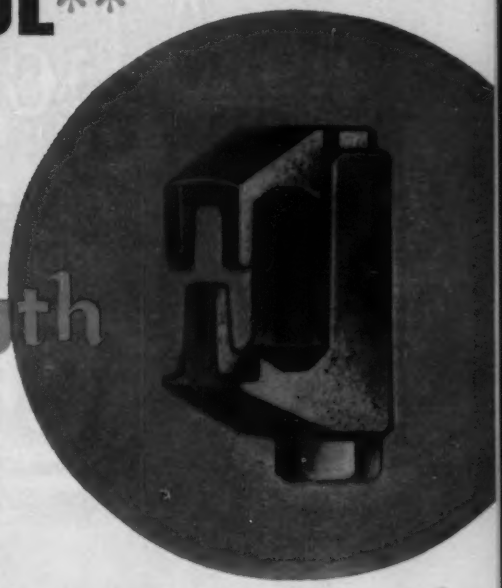
PENN-UNION ELECTRIC CORPORATION • ERIE, PA

meets ESCI* and UL** Specifications

VISE-GRIPS

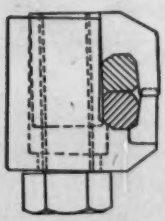
High Strength

Aluminum Silicon Bronze



is used in all sizes . . . the material proved by test to have higher strength than any other material used for conductor fittings . . . used for transformer connector eyebolts, it is stress-corrosion resistant, 90,000 psi tensile strength.

The hex-head bolts are silicon bronze, with rolled threads for maximum strength.



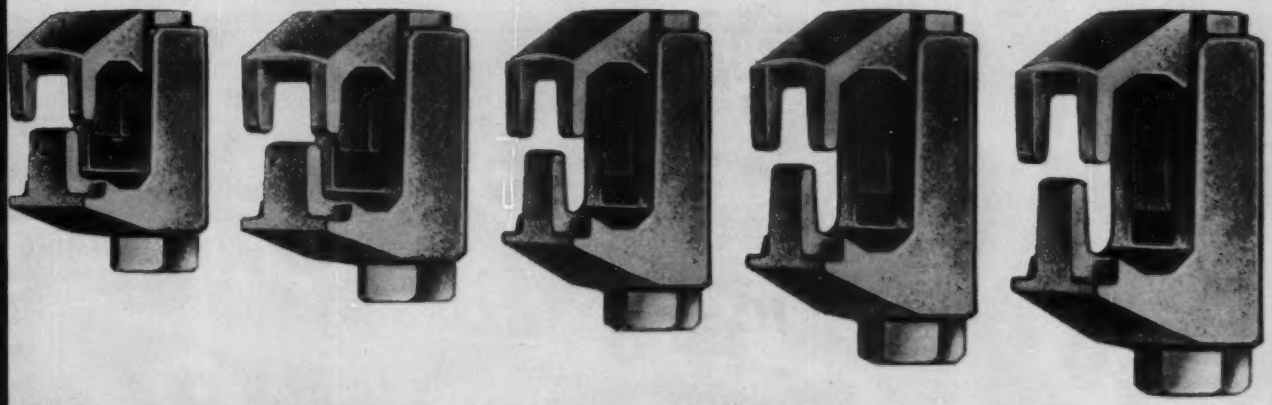
Greater Rigidity under Stress is provided by the design — here's a vise-type connector that will *not* distort under load; ask for design analysis drawings.

The Penn-Union Vise-Grip meets or exceeds all ESCI * and UL ** requirements for tightening torque.

*Electrical Service Connector Institute **Underwriters' Laboratories

TIGHTENING TORQUE IN POUNDS

Max. Cond.	Penn-Union Cat. No.	ESCI *	UL **
8 sol.	F-8	85	75
6 sol.	F-6	120	100
4 str.	F-4		100
2 sol.	F-3	250	125
2 str.	F-2	250	125
1 str.	F-1		125
1/0 str.	F-1/0	250	150
2/0 str.	F-2/0	250	150
3/0 str.	F-3/0		200
4/0 str.	F-4/0	300	200



Get Full Details and Samples

of fittings of this type. Utility men especially will be interested in the design analysis drawings of the Penn-Union Vise-Grip. Sent on request; check the coupon for it—also for samples, telling us the sizes you're using.

Penn-Union Electric Corp., Erie, Pa.

☐ Please send samples of Penn-Union Vise-Grips in sizes _____

☐ Send Design Analysis.

(Your Name) _____

(Position) _____

(Company) _____

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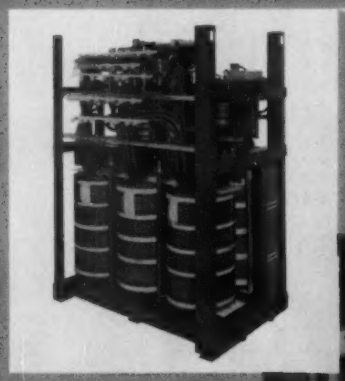
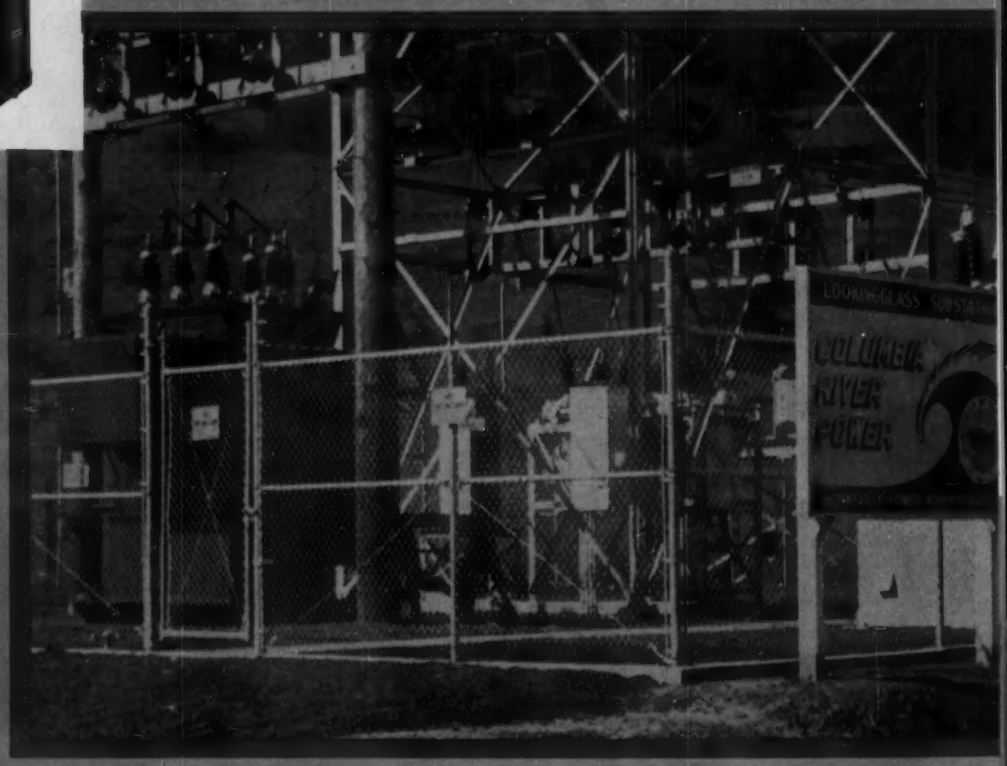
If Alice passed through LOOKINGGLASS tonight...



This internal view of the 750-kva Pennsylvania Step Voltage Regulator shows the exciting transformer, in the foreground, and one coil of the series transformer. Note the rigid supports of the LTC tap leads, and the rugged framework which permits the entire internal assembly to be handled as an integral unit.



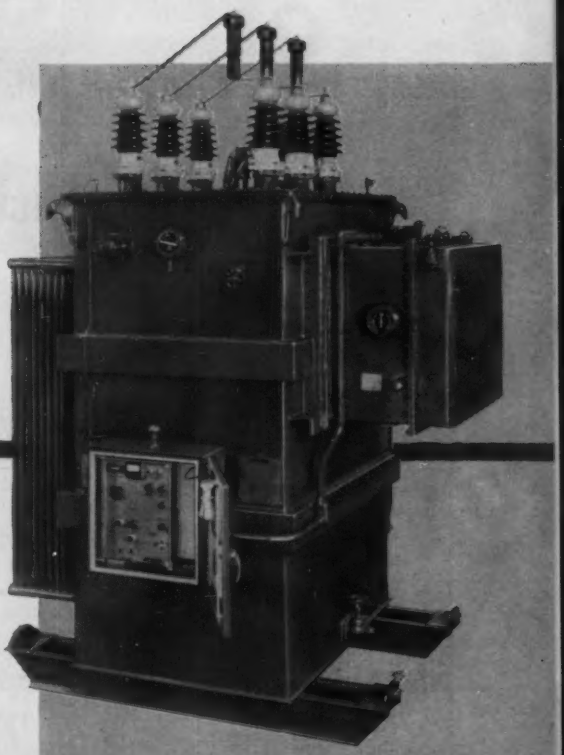
. her way would be lighted with uniform voltage supplied by this 750 kva

Pennsylvania Step Voltage Regulator

If Alice were to pass through Lookingglass tonight, she would see that many changes have been made since her famous nineteenth century trip to the land of topsy-turvy. One particularly marvelous sight would be found just about everywhere: in the streets, in homes, in stores, in barns.

That marvel would be the steady, never-flickering glow of light produced by *well regulated* electricity. In the town of Lookingglass, Oregon — so named, in 1846, because the reflection of the sun in the green grass of the valley created a mirror-like impression — a 750-kva Pennsylvania Step Voltage Regulator is used to maintain an even voltage throughout varying load conditions. As a result, residents of the picturesque valley can enjoy to the fullest extent *any simultaneous combination* of lights, appliances, and other electrical marvels. Alice could toy and experiment all she wanted to with present day electrical curiosities — even during the peak load hours of the day.

Similar Pennsylvania Step Voltage Regulators are performing identical jobs in many communities throughout the United States — helping to transform this country into an electrical Wonderland from coast to coast.



With this 750-kva Pennsylvania Step Voltage Regulator, the Bonneville Power Administration (U. S. Department of Interior) maintains an even flow of voltage for the Douglas Electric Cooperative, Inc., which serves the Lookingglass Valley and adjacent areas. The unit provides 34,500 volts at a rated current of 125.5 amperes. It is equipped with an automatic load tap changer for plus or minus 10% voltage regulation in thirty-two ⅝% steps. (Three phase, 60 cycles, 55°C. rise, OA-outdoors.)

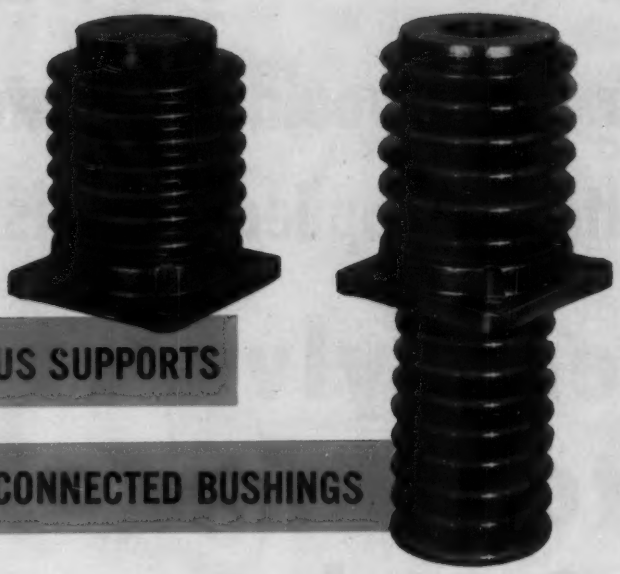
PENNSYLVANIA TRANSFORMER COMPANY

A McGraw Electric Company Division **CANONSBURG, PA.** *Greater Pittsburgh District*

No question

of responsibility

with



Lapp INDOOR SWITCH AND BUS SUPPORTS

Lapp BACK-CONNECTED BUSHINGS

RATING, Kv		2.5	5	7.5	15L	15H	23	34.5
1.5 x 40 withstand, Kv		45	60	75	95	110	150	200
60 ~ withstand, Kv		15	19	26	36	50	60	80
CLASS A	A-10	X	X	X				
	A-20		X	X	X	X		
	A-30		X	X	X	X	X	
CLASS B	B-20		X	X	X	X		
	B-30			X	X	X	X	X
	B-40			X	X	X	X	X
	B-50			X	X	X	X	X
CLASS D	D-20			X	X	X		
	D-30			X	X	X	X	X
	D-40			X	X	X	X	X
	D-50			X	X	X	X	X

Throughout the range of NEMA standards (SG6-6.06) . . . in three design types, in five strength groups, and in voltage ratings 2500 to 34,500 . . . Lapp Indoor Bus Supports and Lapp Back-Connected Switch Bushings are *matching* series. They match in heights, diameters, strengths, and electrical characteristics.

But, in specifying Lapp bus supports and back-connected bushings, you gain more than the convenience and economy of interchangeability. Yours also is the assurance of single responsibility for performance of porcelain, metal parts and complete insulator assembly. And Lapp responsibility always means an extra margin of operating security, low upkeep and long life.

Available as standard or on specification from all leading switch manufacturers.

◀ Lapp Indoor Switch and Bus Supports and Lapp Back-connected Bushings are available as catalog items in matching voltage ratings, strength groups and design classes as indicated at left.

Lapp Insulator Co., Inc., Le Roy, N. Y.

Lapp

15,000 VOLT Anaconda butyl-insulated, neoprene-jacketed aerial cable is field assembled in industrial area in Texas.

How a utility makes friends and influences customers

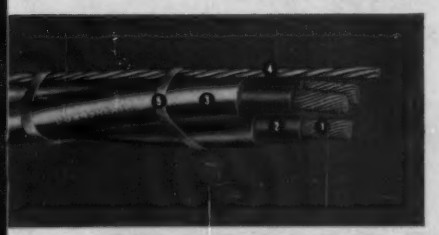
In the eyes of their industrial customers, this utility stands high. To them, aerial cable means *dependable power!* Its compact construction resists damage from trees, wind and ice and snow. And because conductors are closely spaced, voltage regulation is improved.

In residential areas, people are happier, too. Aerial cable is neat, unobtrusive (needs no crossarms) – and reduces tree-trimming.

The cost? Generally lower in the long run–because aerial cable usually costs less to install . . . needs less maintenance . . . and has longer life.

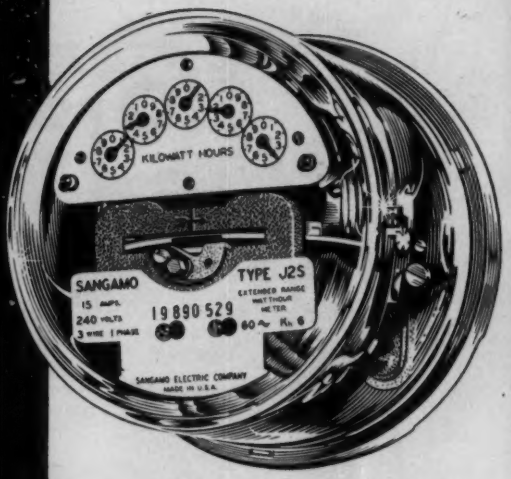
Today's finest aerial cable. Anaconda Aerial Cable is made with special Type AB butyl high-voltage insulation that delivers *extra protection* against ozone, heat and moisture, and with a tough neoprene jacket.

Ask the Man from Anaconda for full information on Anaconda Aerial Cable: 1) factory-assembled, regular or reverse-lay for easy tapping, and 2) field-assembled. Anaconda Wire & Cable Company, 25 Broadway, New York 4, N. Y. 87238



1. Conductors—copper or aluminum **2.** Ozone-, moisture- and heat-resistant butyl insulation **3.** Neoprene weather-resistant jacket **4.** Messenger **5.** Binder Strap

SEE THE MAN FROM ANACONDA®
FOR AERIAL CABLE



Don't take OUR word for it....

LOOK TO YOUR OWN RECORDS

for proof of watthour meter performance!

For all the *facts* about watthour meter performance—how your meters stand up in actual service... how accurately they retain their calibration... how many are damaged by high voltage surges... how quickly and economically they can be put back into service... and what it costs to keep meters on the line—there's no source more reliable than the meter accuracy records of your own Meter Department. These unbiased records are kept for your information as a company executive.

Sangamo J2 Meters provide:

ACCURATE MEASUREMENT from the lightest loads to 100 amperes for the entire life of the meter.

HIGH INSULATION LEVEL to withstand high voltage surges without damage.

CORROSION-RESISTANCE for optimum performance in humid, salt-laden or corrosive atmospheres.

LIFETIME BEARING SYSTEM—proved by millions of Sangamo Meters in service.

PLUS SLOW SPEED! Only ten disk revolutions per minute at full nameplate rating... another reason why the J2 is your best investment in a watthour meter.

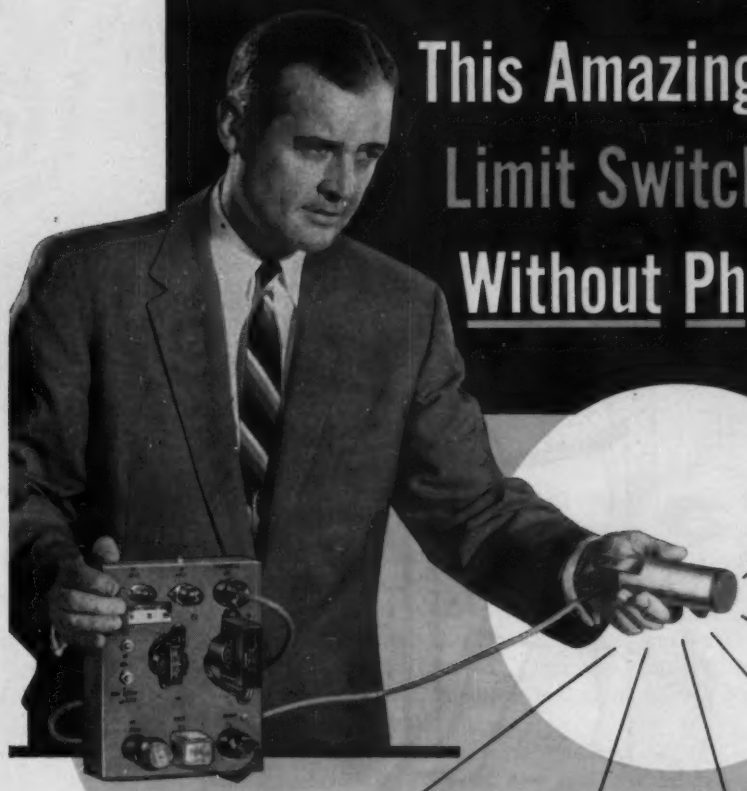
SANGAMO ELECTRIC COMPANY

SPRINGFIELD, ILLINOIS

3. Neoprene weather-resistant jacket 4. Messenger
5. Binder Strap

FOR AERIAL CABLE

This Amazing New Limit Switch Operates Without Physical Contact!



Transducer (sensing head) is actuated by presence of magnetic materials over a wide range of sizes, shapes, weights, roughness, speeds

No moving parts. No metal-to-metal contact required for operation

Sensitivity up to 1 inch

Non-magnetic material between the part and transducer does not affect operation

Small size (1⅞" x 6") Fits into tight spots

Can be mounted in any position. Not affected by vibration

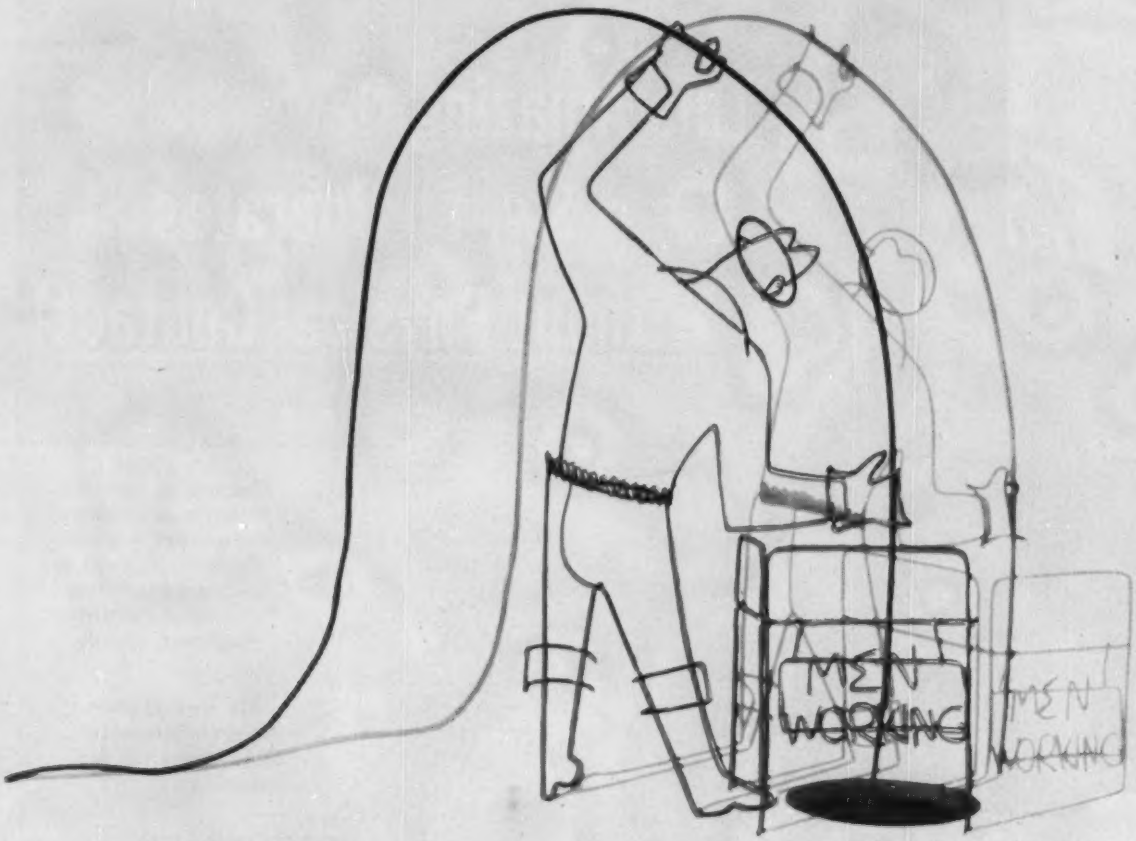
• Here's an entirely new concept in industrial limit switches! We've named it the **PROXIMITY LIMIT SWITCH** because it is actuated by the nearness of ferrous parts or materials. Since its operation requires no physical contact, it has unlimited applications in places where the use of conventional limit switches is either impractical or impossible! Its range of application is broadened, too, because the transducer (sensing head) is not affected by vibration or by the presence of non-magnetic material.

In paint spray systems, on production line presses, multiple process machines, heavy automation equipment—there are literally scores of places where this amazing new PROXIMITY SWITCH will do the job better!

ASK YOUR SQUARE D FIELD ENGINEER FOR A DEMONSTRATION. OR WRITE FOR PROXIMITY LIMIT SWITCH BULLETIN. ADDRESS SQUARE D COMPANY, 4041 NORTH RICHARDS STREET, MILWAUKEE 12, WISCONSIN

NOW...EC&M PRODUCTS ARE A PART OF THE SQUARE D LINE!

SQUARE D COMPANY



Wire sculpture by Henry Szafarz

The Inside Story

Beneath the surface, there's a lot going on.

An underground river of power surges through innumerable cables, supplying the electrical energy that keeps the entire community rolling smoothly.

Throughout the nation, Simplex products are used extensively in such applications. This is particularly true of ANHYDREX XX, the ideal all-purpose cable for high-voltage use. This expertly engineered cable is popularly employed in the 2001 to 35,000 volt range, and has a Conductor Temperature Rating of 90°C up to 5 KV (a rating never attained before the development of ANHYDREX XX).

For more technical data, write for Booklet 1023.

SIMPLEX WIRE & CABLE CO., 79 Sidney Street, Cambridge 39, Mass.

Simplex Anhydrex XX Underground Cable

Simplex

NEWS-SCOPE

FUTURE NEWS ▶

Rural electric co-op leaders meeting in Chicago this week will gird for battle to hold REA interest rates at 2%. With government paying more for its money, there's been some talk in Congress of edging up REA loan rates.

Higher corporation taxes are a possibility. Here's one proposition that's being discussed in Washington now: Normal taxes would be cut to 22% from present 30%. But surtax on profits in excess of $25,000 would be raised from present 22% to 31%. Result for most utilities: a federal corporation tax of 53% instead of present 52%.

Atomic progress: Group of Southwestern electric utility executives are meeting to consider building a power reactor; AEC will declassify some information on reprocessing of fuel elements.

LATE NEWS ▶

Douglas County PUD (Wash.) decides to seek permission to build $110-million, 414,000-kw Wells project on Columbia River. If dam is built, Kaiser Aluminum & Chemical may construct an aluminum reduction plant in the area.

Two AEC commissioners challenge charge of inadequacy made against the present power reactor program by Commissioner Thomas E. Murray. The men, Harold S. Vance and Willard F. Libby, rebutted Murray's criticism during Joint Committee on Atomic Energy's hearings probing status of civilian atom program.

Proportion of new and rewired homes installing larger entrance equipment rose on Western Massachusetts Electric's system from 5% in 1955 to 40% last year.

Rochester Gas & Electric spins fourth and largest unit at Russell Station. The 83,500-unit brings station's maximum generating capability to 275,500 kw.

Florida utilities may convert their power plants from oil to coal usage. This was disclosed by Sen Thruston B. Morton (R-Ky.) after meeting of Florida utility leaders, and coal and southern railroad executives. Morton said coal from southern bituminous areas, West Kentucky, and other sections now can be delivered to the state "as cheap as or even cheaper than competing fuels."

Central Vermont Public Service seeks SEC approval to acquire 86.5% of the common stock of Vermont Electric Power Co. The latter was recently organized to transmit Vermont's share of St. Lawrence power.

Consolidated Edison is offering $54,827,500 convertible 4½% debentures due 1972 to commonholders on basis of $100 principal amount of debentures for every 25 shares of common owned on Feb. 25 at $100. Expiration date is March 15. Morgan Stanley & Co and First Boston Corp group are underwriters.

Electric, gas, and water utilities offered $2.53 billion in corporate securities in 1956, compared with $2.46 billion in 1955, reports SEC.

Congratulations . . . President Eisenhower has nominated Olin H. Chilson as Under Secy of Interior to succeed Clarence A. Davis, resigned. Chilson is presently an assistant secretary . . . **New manager of market research** for Anaconda Wire & Cable is Ary Mossiman, who formerly held the same post at Electrical World.

ELECTRICAL WEEK

A TWO-MINUTE

INSIDE TVA ▶ **"I would like for the executives of other electric utilities to know** that we have no secrets here," TVA Chairman Herbert D. Vogel says in an exclusive Electrical World interview. "We would welcome any exchange of information and visits that would be mutually helpful." In candid answers to frank questions, Vogel discloses the changes he hopes to make if he gets a majority on the TVA board. He tells why he favors revenue bond financing for expanding power facilities. Yes, and he tells you about his pet hate in the TVA job (p 51).

EVENTS ▶ **First nationwide roundup of National Electrical Week activities** shows tremendous use of all advertising media to get message across. Governors of ten states issued NEW proclamations. Utilities showed up best in local presentations (p 54).

Compete for honor and a share of the $5,400 in prizes in the lighting contest being sponsored by Electrical World and sister publications. There's a category for you if you design, sell, install, or promote lighting jobs (p 58).

ATOMIC PROGRESS ▶ **Is industry moving fast enough in developing nuclear power?** That's the big question as Congressional hearings get underway on nuclear progress. AEC Chairman Strauss says "yes." Commissioner Murray says "no" (p 56).

Group of 12 electric utilities operating in the east north central region declare intention to build prototype nuclear plant which will develop high temperatures and pressures in effort to advance toward economic nuclear power generation (p 50).

TRANSMISSION ▶ **Shielded wood-pole transmission lines greatly reduce outages** due to lightning, a recent study by Consumers Power Co shows. Engineer Brent Ottinger compares performance of shielded lines with unshielded ones in an article that may help you determine the best design for your future lines (p 61).

Special 9-ft pre-formed guy grips were used to repair strand breaks about 4½ ft from a dead-end thimble on an Otter Tail Power Co 2,000-ft span across water. Conductor was ½-in. extra-high-strength, seven-strand steel (p 86).

SUBSTATIONS ▶ **You'd have a difficult time spotting a substation** in the newer residential areas of Minneapolis-St. Paul. Reason is that Northern States Power Co is putting its subs right into residential-type buildings. Engineers E. C. Ward and E. I. LaSere tell how to build and maintain "substations that look like homes." (See cover and p 64).

Another substation design finding acceptance in residential areas provides complete enclosure of all energized equipment for station-type regulators. This modified regulator design used by Pacific Gas & Electric promotes safety and reduces space requirements (p 80).

DISTRIBUTION ▶ **Here's the article you've been waiting for on capacitor fusing.** It describes the various functions of these cutouts and tells how to select the kind and size you need for the protection you desire (p 67).

Go after that shopping center load! It's likely to be sizable. It has a good load factor. And it will be a pace-setter for other commercial customers in the community. But this "best of commercial loads" can be pretty demanding, too. By its nature it springs up outside of the downtown network area. Yet it still calls for a high degree of service reliability and a low variation of service voltage. Estimating data are summarized in **easy-to-read charts** (p 71).

A cutout arranged for quick, temporary installation helps in running down distribution line faults. Brainchild of L. C. Valley, an area supervisor for Appalachian Electric Power, the device enables troublemen to isolate faulted sections and speedily restore electric service on usable portions of the circuits (p 77).

SELLING ▶ **Heat pumps may be one answer to your load problems.** Florida Power Corp, which has some 40% of the nation's heat pumps on its lines, finds they provide greater revenue per kw of demand than any other individual or combined type of heating and cooling. G. C. Hall, supervisor of the utility's air conditioning department, tells how the load has been built and what it means in terms of electric revenue (p 90).

A new 240-v plug-in bus duct system, installed without interrupting production, now meets all power system requirements for an electronic components maker. Lighting, soldering pots, and ovens which need a 120-v supply are fed from local transformers . . . Electrically heated plastic bath at Scott Aviation Corp helps assure uniform plastic coatings without hazard to plant or personnel (p 94).

MANAGEMENT ▶ **Electric companies plan to put out more common stock during the first quarter** of this year than they did in all four quarters of last year as high interest rates discourage debt offerings. Rights offerings gain in popularity. Management Bulletin also gives tips to avoid conflicts in informational meetings (p 115).

Does your company newspaper or magazine spark reader interest? Jack Palmer, who edits the "Illuminator" for Appalachian Electric Power, tells how a readership survey helps him aim editorial content to get better readership (p 60).

Employment is off more than usual and unemployment is up a little more than anticipated. But the situation is not serious enough to greatly affect utility kwhr sales . . . Also there's a brighter view of consumer credit (p 113).

PEOPLE ▶ **Hall M. Henry is new president and Harding U. Greene is new vice president** at New England Gas & Electric Association Service Corp. Also, Harold W. Atkinson is named general manager of Cambridge Electric Light Co, a NEGEA subsidiary . . . O. P. Reed moves up to become manager of employee relations at Public Service Co of Colorado. Paul E. Brookover succeeds Reed as vice president and general manager of Cheyenne (Wyo.) Light, Fuel, & Power Co, a PSC subsidiary (p 120).

MANUFACTURERS ▶ **Square D Co earnings passed the $100-million mark for 1956**—a gain of 28% over the previous year's $78 million, which was a record up until that time. Three new plants were under construction and two others were being modernized as Square D issued its report . . . General Electric Co sales for 1956 climbed 18% above the previous year and earnings set a new record of $213.8 million. This gain was reflected in record corporate and employee earnings, payments to suppliers, dividends, and plant expansion. GE Pres Ralph Cordiner said earnings did not keep pace with sales gains because of "the unfavorable price situation" (p 109).

NEW EQUIPMENT ▶ **New off-peak control time switches,** rated at 35 amp, have molded nylon gear train assemblies and large contacts which reportedly increase their durability . . . Voltage regulator bypass switch, rated 400 amp at 7.8 kv and 200 amp at 15 kv, is available for regulators which can be set in neutral position. Each bypass would replace three disconnect switches (p 97).

ENGINEERING TRENDS

Gas-cooled reactors of about 150-Mw electrical capability from 500 to 600 Mw of heat, patterned after the Calder Hall installation, are immediately practical and economic without being dependent upon development of new materials, according to comments recently reported in *The Electrical Journal.* Some nuclear engineers and scientists think that reactors do not need ratings high enough to require liquid coolants in order to be economic. Others look to the Calder Hall type as the only commercial proposition for large base-load power plants for many years to come.

Transmission towers over 100 ft high are tested in an abandoned quarry, according to *Electrical Review.* The steep walls of the narrow British pit enable precise application of horizontal loadings and shield the structures from unwanted wind effects. At the same time they provide stable points from which to observe the effects of loading to destruction.

Called the "Gamecock", a 3-ton vehicle provides an insulated platform for low-voltage work which can hoist two men and their tools to a height of 40 ft to overhead conductors and equipment. The vehicle also carries a 5-man cab and extensive storage space for additional tools.

Unit size and steam conditions are stepping up in British generating plants, according to *Electrical Journal.* This year's model is 120 Mw, 1,500 psi, with reheat to 1,000F. Units planned for 1959 will be 200 Mw, 2,350 psi, with reheat to 1,050F. But the 1962 model will be 550 Mw, 2,300 psi.

Germanium rectifiers will power railway coaches for British electrification, taking power from a 25-kv, 50-cps, single-phase supply system. This decision was based upon successful trail of a 750-kw coach unit last year, according to *McGraw-Hill World News.*

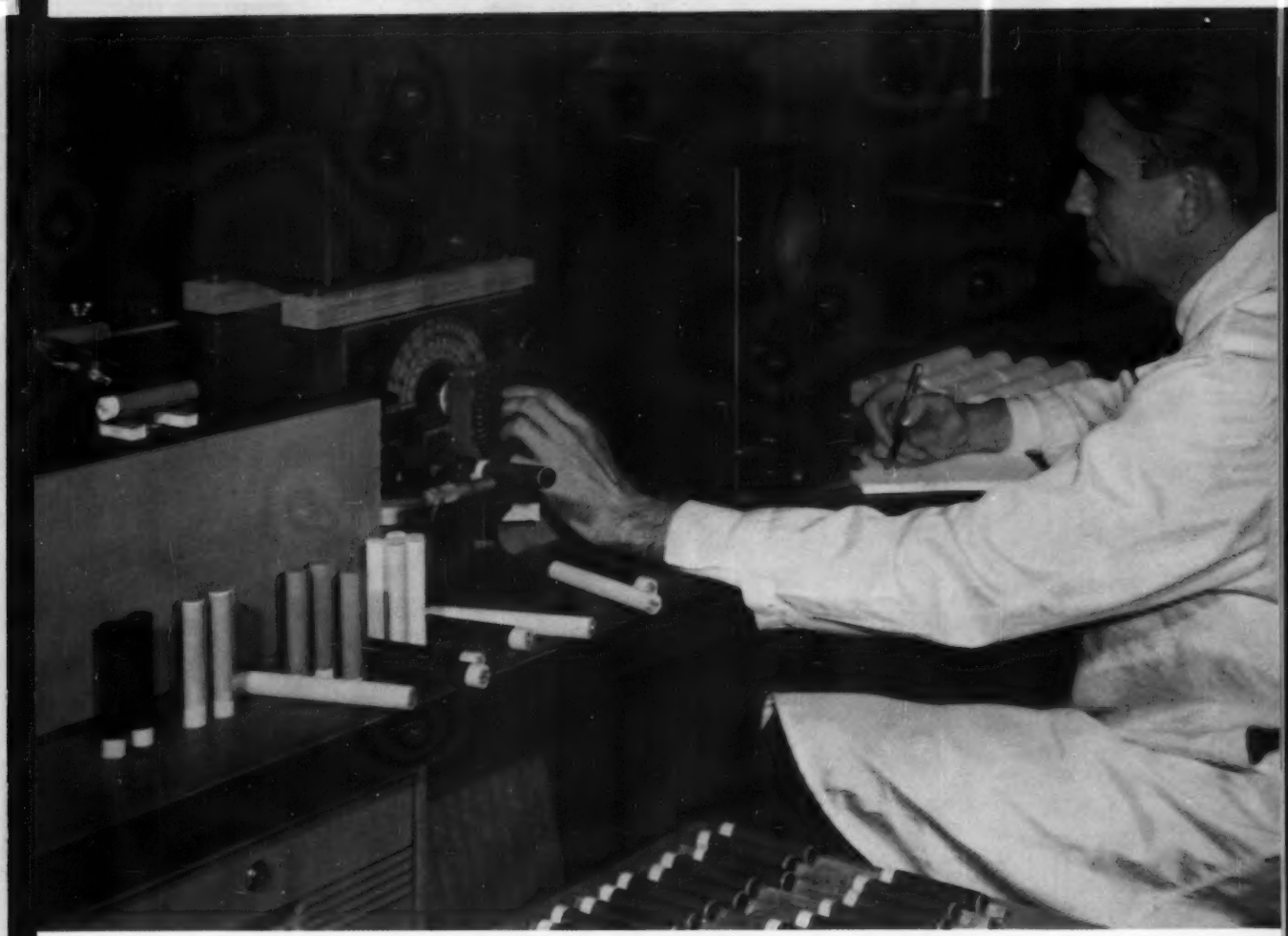
FROM EDITORS IN THE FIELD

Mercury and fluorescent units have boosted street illumination to two to five times the previous level for 7 municipalities served by Connecticut Light & Power Co.

Taps from the 25-kv subtransmission for distribution in non-urban areas are under consideration by Cape & Vineyard Electric Co. Both single and three-phase connections are contemplated for fast-growing loads.

Colored snap-on buttons indicate switch positions on a new dispatcher's board installed by South Carolina Electric & Gas Co. The buttons fit heads of special nails driven into the plexiglass-surfaced plywood panels on which lines are represented by colored tape stuck to the surface.

Deadends for three 477-Mcm ACSR conductors of urban 44-kv lines will be supported on three 5 x 5-in. x 8-ft crossarms with conductor tension limited to 3,000 lb for short-span construction in the new practice adopted by South Carolina Electric & Gas Co.



HE'S LISTENING TO THE TRUE STRENGTH OF PORCELAIN

New ingenious way of measuring strength improves O-B insulator production control

This man is listening to the strength of porcelain! It's a new test method devised in the O-B Ceramic Research Laboratory to get quicker, better answers to one of the most important questions in the insulator business -- strength of the porcelain body. It permits closer control of the manufacturing process. It gives quicker warnings of trouble. In short, it's a help in making better insulators.

You know the old story of the violinist who, with a sustained note of exact pitch, could shatter a glass. Here, we substitute a porcelain sample for the glass and a loud speaker for the fiddle. Pitch is controlled with a signal generator. Vibration of the porcelain is detected by a phono-pickup. At some critical note, the porcelain goes into resonance which is observed on the screen of an oscilloscope. This data which can be obtained with great precision, is used in the calculation of strength. It is done almost in a matter of seconds, compared to laborious hours under older methods. It does not destroy the specimen. Its accuracy is unaffected by extraneous factors that always crept into other tests. It is a new approach to an old problem.

Raising the whole technical plane of porcelain production is one of the interesting and valuable projects now being pursued by the Ohio Brass Company. This is one more reason for the exceptional service -- and exceptional value -- you get with O-B insulators.

OHIO BRASS COMPANY, MANSFIELD, OHIO
Canadian Ohio Brass Co., Ltd., Niagara Falls, Ont.

TECHNICAL COMPETENCE

Ohio Brass

4817-H

THE HEART OF EVERY INSULATOR

NEW O-B BUSHING
Works all the insulation ...Overworks none of it

Every new O-B bushing, all the way from 15 to 230 kv, uses "full condenser" construction of the insulating core. Concentric foil layers, acting as plates, decrease in length as they increase in diameter in order to maintain uniform area. During the paper winding operation, spacing of these plates is held to a high degree of accuracy . . . In a condenser where plate area and dielectric spacing are equal, voltage is uniformly divided. In this way, the total bulk of insulation in the O-B bushing is worked efficiently; each dielectric zone taking an equal share of the voltage, and subjected to extremely conservative stress . . . This permits combining the slender form of O-B's new bushing with high operating reliability and generous safety factors at all voltage ratings . . . These bushings are now available for application to your new station equipment.

4642-H

Ohio Brass

MANSFIELD OHIO, U. S. A.

WINCO® Gives You NEW ECONOMY IN PORTABLE ELECTRIC POWER

with the Exclusive New

Automatic CONSERV-er IDLING CONTROL

- Extends Engine Life
- Reduces Fuel Consumption
- Lowers Maintenance Cost

MODEL 205B14S2D-1149, equipped with Automatic CONSERVER IDLING CONTROL #24042. Carrying Cradle #23410 optional equipment.

AUTOMATIC CONSERV-er IDLING CONTROL—
Plant AUTOMATICALLY idles except when load of 75 watts or more is applied.

205B14S2D Series—
New 2500 watt Direct Drive model, 115, 230, or 115/230 volts, 60 cycles, A.C. Control box with receptacles standard equipment.

LIGHT WEIGHT—Only 161 pounds including optional carrying cradle and optional Automatic Conserver idling control.

RECOIL STARTER—Optional equipment at extra cost.

SUPER POWER—King-size generator gives you close, steady, voltage regulation.

EASY TO START—4-cycle Briggs & Stratton engine gives you quick, easy, dependable starting.

EASY TO SERVICE—Engine parts & service stations readily available.

EASY TO USE—Speedy-Shift 2-wheel dolly for quick portability. Easily attached or removed. Optional at extra cost.

A COMPLETE LINE OF WINCO ENGINE-GENERATORS AVAILABLE FOR YOUR INDIVIDUAL POWER NEEDS THROUGH 10,000 WATTS.

WINCHARGER CORPORATION
Sioux City, Iowa
Dept. EW-37

Please send me full information about Winco portable electric plants with the exclusive new Automatic CONSERV-er.

Name _____

Address _____

City _____ State _____

Manufactured by WINCHARGER CORPORATION . . . . Sioux City, Iowa
Subsidiary of the Zenith Radio Corporation

DEAD END WITH

BLACKBURN

W6-2A from 6 Sol to 2 ACSR
This Clamp Will Handle All Popular Service Drop Wires

WEDGE CLAMPS

For Light Service
W6-4A
6 Sol to 4 ACSR

For Heavy Service
W2-OA
2 Sol to 1/0 ACSR

Conductor in contact with wedge for entire length of slider.

Removable aluminum slider allows installation without threading through clamp.

Drop wire can be pre-sagged and cut to exact length needed.

Can be attached to bare neutral at any point in the span.

Your Choice of 3 Bails

STANDARD | FLEXIBLE CAPTURED | FLEXIBLE FREE

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KUHLMAN "Salesman of the Week"

If you can identify this Kuhlman Electric Co. representative, and are the first one to notify Dept. SA-1, Kuhlman Electric Co., Bay City, Mich., you will receive a valuable gift certificate. Watch for the next Kuhlman "Salesman of the Week."

"QUICK GRIP" for 5 KV and below with the new big grip knob for quicker, tighter line connections.

NEW "QUICK GRIP" for voltages above 5 KV with all live parts protected from birds and animals.

"Here's my favorite success story . . .

"The story begins in 1939 when Kuhlman developed 'Quick-Grip' to solve a particular customer's problem. It proved so successful that it was incorporated into the Kuhlman line. Today, it is universally used as the fastest, safest and most convenient way to make a line connection.

"The story continues when Kuhlman extended the 'Quick-Grip' feature above 5KV to again solve a customer's problem. This 'Quick-Grip' bushing in cover mounted design eliminates the extra expense of bird guards and other protective coverings.

"I like this success story . . . it illustrates how Kuhlman representatives and design engineers work together to solve your transformer problems. What's more—it's a story that never ends . . . for the search for better ways to meet your needs goes on continually at Kuhlman."

578c

KUHLMAN

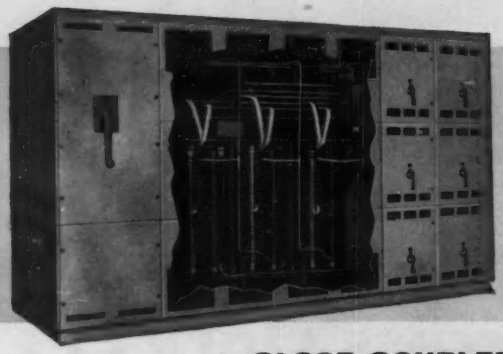
ELECTRIC COMPANY

BAY CITY, MICH. CRYSTAL SPRINGS, MISS. SALINAS, CALIF.

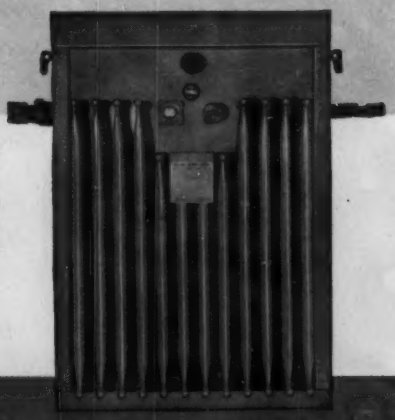
Can your in-plant distribution

WAGNER UNIT SUBSTATION

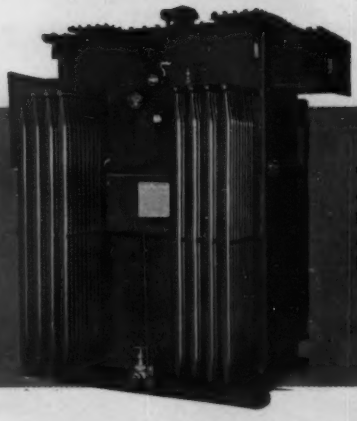
continuous dependable



DRY TYPE (OPEN, VENTILATED)—For indoor use only. Normally installed in a dry, dust-free atmosphere in a well-ventilated location. Light in weight... ideal for multi-storied buildings... no fireproof vaults necessary.

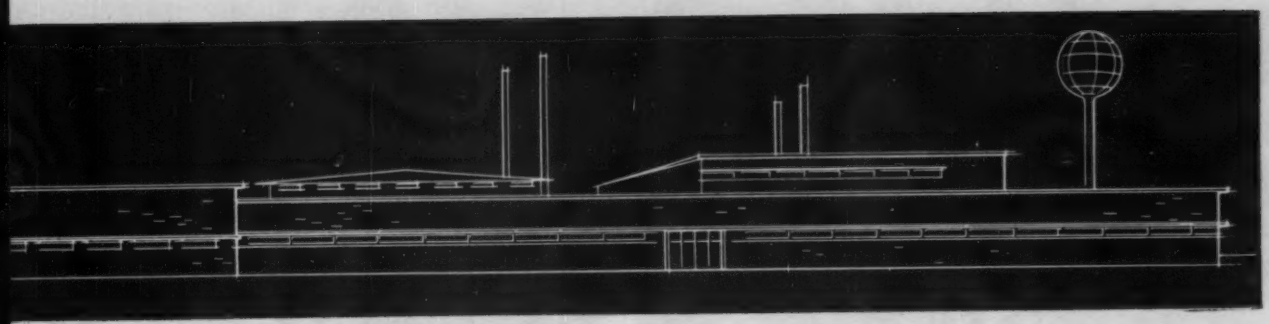


CLOSE-COUPLED. These liquid-filled transformers fit flush against switchgear enclosures, eliminating throats and saving space... available in ratings from 500 through 2000 kva. Connections are made at the bushings on the sides of the transformer.



OIL AND NOFLAMOL-FILLED. Oil-filled transformers are generally used outdoors. They can be used indoors if fireproof vaults are provided. Noflamol type in this model is filled with a non-inflammable liquid making it especially suitable for chemical plants, refineries and other locations where explosive liquids and gases are present.

NITROGEN-FILLED. These Class H Silicone Insulated Transformers offer many advantages in maintenance and safety. Suitable for indoor or outdoor use ... covers are welded to tank... no cleaning problems, even in dust-filled areas... completely fireproof. In ratings up to 2000 kva.



system meet tomorrow's needs?

TRANSFORMERS will assure power for years to come

Nothing is more important to your plant than an uninterrupted flow of power. You can't afford to be handicapped by a system that is unable to meet expanding demands. Your in-plant distribution system must be planned with an eye to the future—with plenty of capacity and flexibility for growth.

It will pay you to check over your distribution system—find out how adequately your transformers meet present and *future* load requirements.

And it will pay you to specify Wagner PREDESIGNED Transformers for your load-centers. You will save time—save job engineering costs—and get liberally designed transformers with the switchgear of your choice. Wagner PREDESIGNED Transformers are engineered to meet heavy industrial demands. They are built in standard ratings which are coordinated with the specifications of unit substation builders.

Bulletins TU-205 and TU-214 give full information on Wagner Unit Substation Transformers for industrial power needs. Write for your file copies today.

WAGNER DRY-TYPE TRANSFORMERS
put the right voltage close to the load

Save money through shorter runs of copper, reduced line losses, and lower installation expenses. These Wagner Dry-Type Transformers are compact, light in weight and safe to use. No fireproof vaults or other enclosures necessary... install inside or out. The 150° rise transformer is standard in ratings 3 through 10 kva and is also available through 50 kva. 55° rise model is standard in 1, 1½ and 2 kva, and the 80° rise transformer is standard in ratings 15 through 100 kva. Write for Bulletin TU-57 for full details.

Wagner Electric Corporation
SERVING INDUSTRY SINCE 1891

BRANCHES AND DISTRIBUTORS IN ALL PRINCIPAL CITIES
Wagner Electric Corporation
6456 Plymouth Ave., St. Louis 14, Mo., U.S.A.

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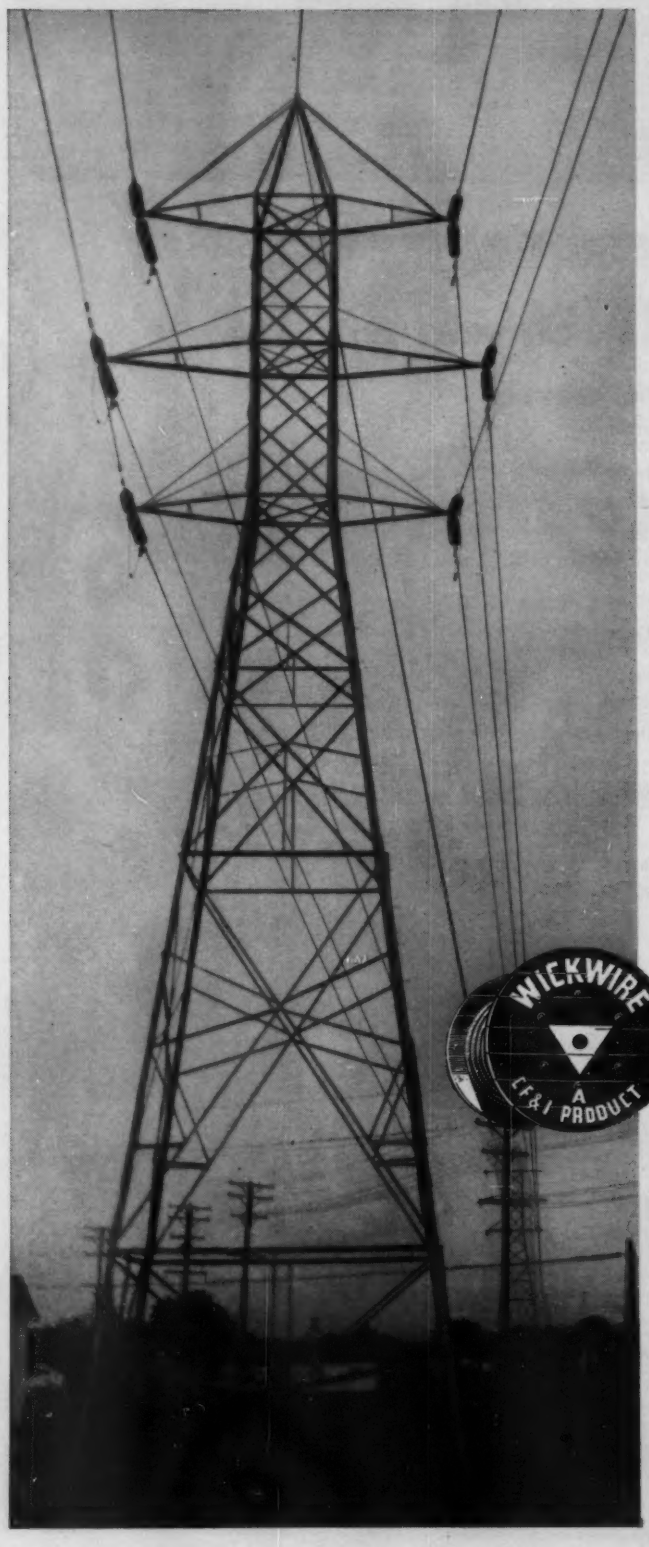
ELECTRIC MOTORS • TRANSFORMERS • INDUSTRIAL BRAKES • AUTOMOTIVE BRAKE SYSTEMS—AIR & HYDRAULIC

CF&I GALVANIZED STEEL STRAND



for guy, messenger and overhead ground wire . . . quickly available from both eastern and western plants

No matter what part of America you're in, CF&I can quickly supply your needs for top-quality, guy, messenger and overhead ground wire. That's because three- and seven-wire CF&I Galvanized Steel Strand is made at both Buffalo, N. Y., and Pueblo, Colo.—a combination of plant sites that's ideal for speedy, nationwide distribution.

What's more, you can be sure of the quality of CF&I Galvanized Steel Strand because every phase of its production is supervised by the manufacturers of world-renowned Wickwire Wire Rope and Wire Rope Slings.

Next time you need strand—whether it's to your own specifications or to ASTM Specifications A-122 or A-363—be sure you explore the many advantages offered by CF&I Galvanized Steel Strand. Better still, contact your nearby CF&I representative today.

CF&I

GALVANIZED STEEL STRAND

THE COLORADO FUEL AND IRON CORPORATION

Albuquerque • Amarillo • Atlanta • Billings • Boise
Boston • Buffalo • Butte • Chicago • Denver • Detroit
El Paso • Ft. Worth • Houston • Kansas City • Lincoln (Neb.) • Los Angeles • New Orleans • New York
Oakland • Oklahoma City • Philadelphia • Phoenix
Portland • Pueblo • Salt Lake City • San Francisco
Seattle • Spokane • Wichita

CF&I OFFICES IN CANADA: Montreal • Toronto

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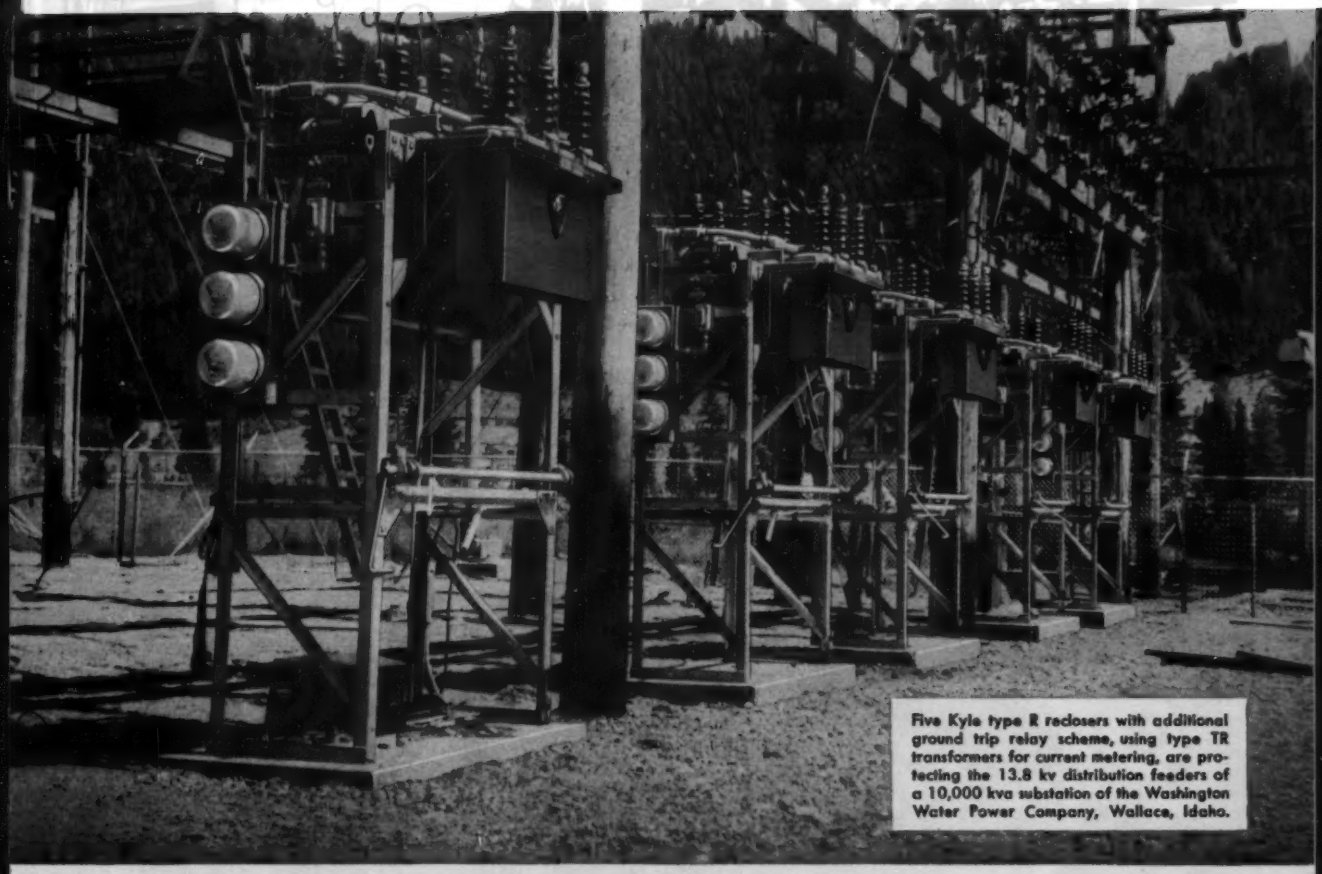


Five Kyle type R reclosers with additional ground trip relay scheme, using type TR transformers for current metering, are protecting the 13.8 kv distribution feeders of a 10,000 kva substation of the Washington Water Power Company, Wallace, Idaho.

Up To 90% Of Transient Faults Cleared . . .

High-Speed Kyle Type R Reclosers Help Improve Service Continuity

by **R. L. LEMMAN**
Apparatus Engineer
Line Material Company

L-M Kyle reclosers provide high-speed (2-cycle maximum) clearing of faults on the distribution system. This minimizes permanent system faults resulting from transient or non-persistent causes, and greatly improves service continuity. Up to 90% of transient faults can be cleared with Kyle reclosers with no significant damage to conductors.

Substation Applications

The Kyle type R three-phase recloser is a completely automatic, self-contained power class unit. Because the type R is a heavy-duty recloser it has applications in substations with up to 100,000 kva fault capacity.

The type R provides simultaneous tripping on all three phases of the feeder, to assure maximum protection against back feed or three-phase motor burnouts. Three time-current characteristics are available for series over-current tripping, with four operations to lockout in any of seven sequences. Normal reclosing time is two seconds. (25-cycle reclosing is available by simple field adjustment.)

Auxiliary Protective Schemes

Almost any relay scheme is adaptable to the type R recloser to supplement normal series over-current tripping.

Ground Trip Solenoid is a self-contained ground relay possessing its own dual time-current characteristics.

Shunt Trip Solenoid is a tripping device only, designed to operate the recloser when energized from a supplementary relay scheme.

Shunt Lockout Solenoid is a lockout device only; locks out the recloser instantly. Like the shunt trip solenoid it is energized by remote control.

Auxiliary Switch provides positions for remote-control indication or low-voltage control switching of apparatus used in conjunction with the type R recloser.

Ratings From 25 to 400 Amps.

The type R is available in normal load ratings from 25 to 400 amperes, with symmetrical RMS interrupting ratings up to 6000 amperes at 4.8 kv and below, and 4000 amperes up to 14.4 kv. Ratings can be increased in the field by simply changing the series trip coil.

Get the Whole Story on L-M's Kyle Reclosers and Sectionalizers

Ask your L-M Field Engineer for information and bulletins on Kyle apparatus and complete coordination—single- and three-phase—from substation to load. Or write Line Material Company, Milwaukee 1, Wisconsin. In Canada: Canadian Line Materials, Ltd., Toronto 13, Ontario.

264

LINE MATERIAL Kyle® Reclosers

A McGRAW ELECTRIC COMPANY DIVISION

"NOTHING TO IT!...Putting Up the

CARL HAWKINSON
Superintendent
Edwards Construction
Company
Geneseo, Illinois

"Nothing to it," says "Swede" Hawkinson. "First, slip the aluminum housing over the 2-inch support member and turn the housing *upside down*. Easy going—you're on top of the job, and in good working position—not underneath, working up like you are on other units."

"Hook up the primary. Terminals have tin-plated pressure-pad connectors to speed up the installation. The reflector assembly mounts on the housing with just three cotter-type hinge pins. Now, flip the reflector open to connect the leads. And see how the friction-type connectors save time."

LM®

LINE MATERIAL

A McGRAW ELECTRIC COMPANY

New L-M Fluorescent Luminaire Is Easy!"

That's the word from Carl "Swede" Hawkinson. "Nothing to it . . . one man can do the job. All you need is a screwdriver, a crescent wrench, and a level."

For a fact, the new L-M fluorescent luminaire is *remarkably* easy to install. You will understand why, as you study the photographs and explanation by "Swede" Hawkinson, competent and well-liked superintendent of the Edwards Construction Company, Geneseo, Illinois.

And bear in mind—this easy-to-install design by L-M offers *many* exclusive engineering advantages. In addition, L-M's new fluorescent luminaires present a *new look* in street-lighting equipment. They are styled for handsome appearance, correct light distribution, and a lifetime of efficient, economical operation.

Outstanding Features of L-M's New 1957-Style Fluorescent Luminaire

Shipping: Unit comes in two separate packages to make it easy to handle. The housing is in one package; globe and reflector assembly are in the other.

Housing: One-piece aluminum housing with reinforcing ribs provides strong, rigid mounting. Aluminum housing also provides excellent heat dissipation. Neoprene gaskets seal globe to housing and support entry, provide weatherproof construction.

Ballasts: Ballasts are mounted directly to flat inner surface of aluminum housing. This allows maximum heat dissipation during operation.

Ballast leads have friction-type terminals. Wiring is completed quickly and easily without tools.

4-lamp units have two ballasts, with one lamp from each side paired to each ballast.

Reflector: Two-piece reflector has separate, efficient reflecting surface for each lamp. Assembly is hinged and retained by spring-type latches to provide easy access to input terminals, ballasts, internal wiring, and mounting clamps.

Opening or removal of reflector assembly is accomplished without removal of lamps from their sockets.

Lamps: Only unit available today designed to take both present and future very high output (VHO) fluorescent lamps.

Globe: One-piece Plexiglas® globe is strong, virtually free from strain. Unit is latched and hinged to open from either side to provide easy accessibility for installation, wiring, cleaning, or relamping. "Breather" holes are provided in bottom of globe. Holes are covered with fiber glass filters to keep out dust and insects.

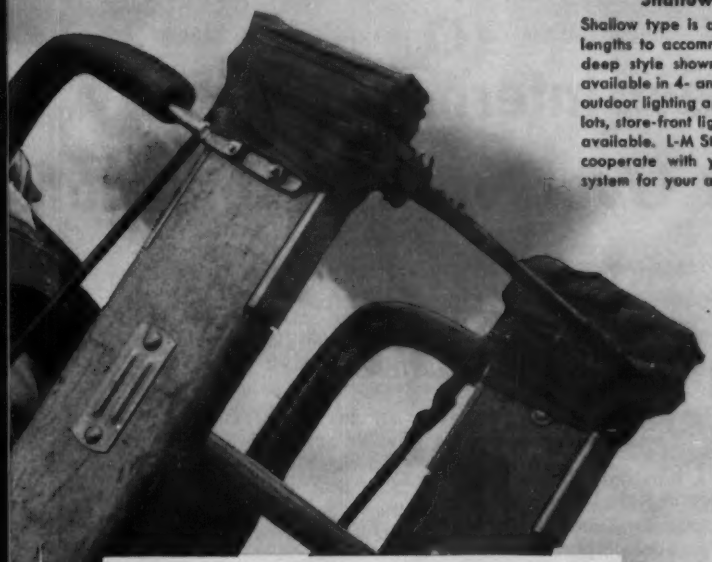
Wiring: Input terminals accommodate wire up to No. 4 stranded. They are tin-plated for use with either copper or aluminum conductor. Input circuit is arranged for operation on either 2- or 3-wire system.

Get Complete Information

Ask your L-M Field Engineer or Street Lighting Engineer for more complete information. Or write Line Material Company, Milwaukee 1, Wisconsin. In Canada: Canadian Line Materials, Ltd., Toronto 13, Ontario.

Shallow-type luminaire

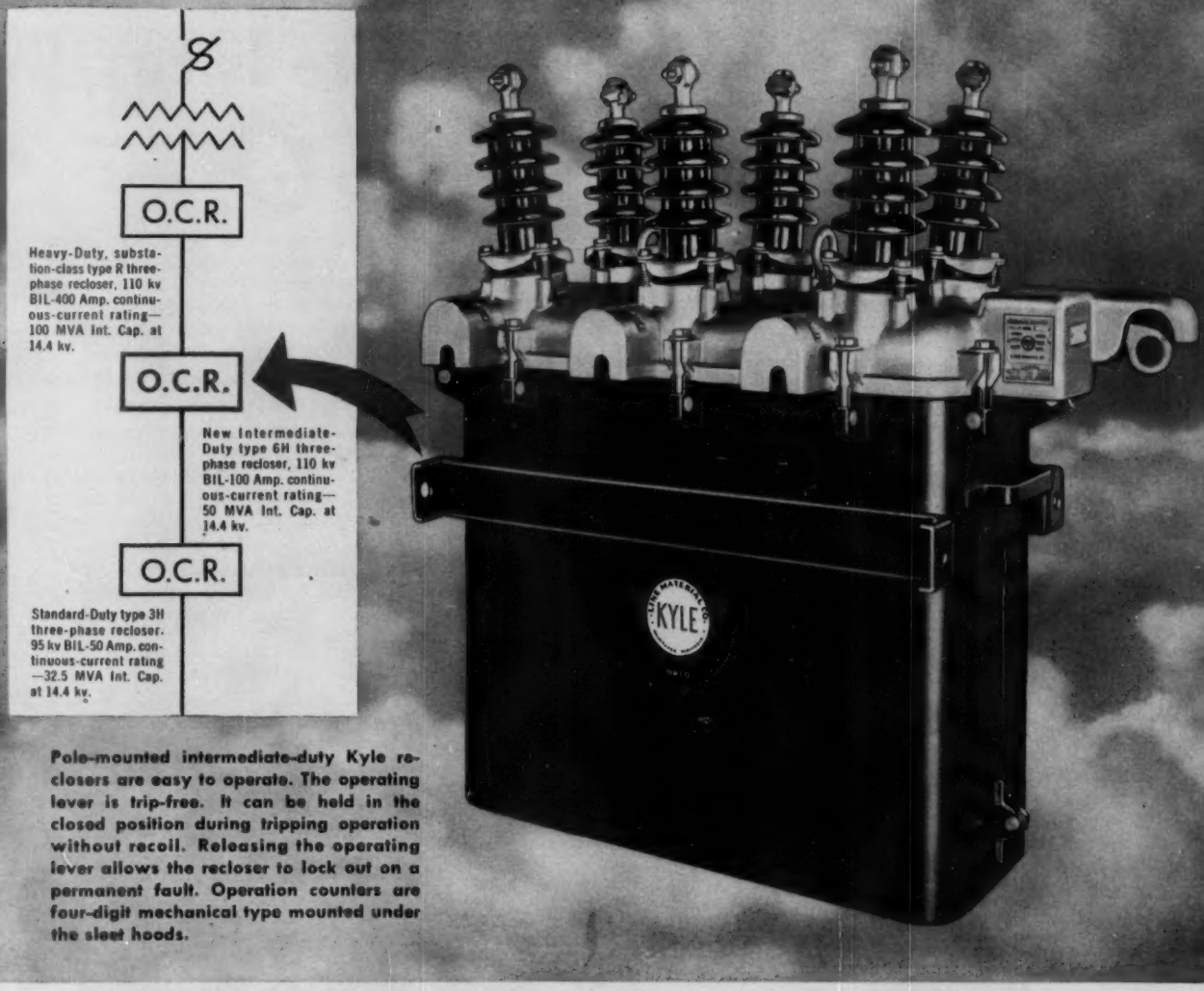
Shallow type is available in 4- and 6-foot lengths to accommodate 2 or 4 lamps. The deep style shown in photos below is also available in 4- and 6-foot lengths. For other outdoor lighting applications, such as parking lots, store-front lighting, etc., other styles are available. L-M Street Lighting Engineers will cooperate with you in designing the best system for your area.



"Next, turn the whole assembly 180° to normal position. Level and tighten up two interior clamping screws, and lock the reflector assembly in place with three twist-lock hasps. The two-piece reflector has separate reflecting surfaces for each lamp."

"All right! Now you put in the four fluorescent lamps, swing the globe assembly up into latched position, and the unit is ready to be fired up. The whole installation can be done in a matter of minutes. *Nothing to it!* . . . Putting up the L-M Fluorescent Luminaire is *easy!*"

Street Lighting


O.C.R.
Heavy-Duty, substation-class type R three-phase recloser, 110 kv BIL-400 Amp. continuous-current rating—100 MVA Int. Cap. at 14.4 kv.
O.C.R.
New Intermediate-Duty type 6H three-phase recloser, 110 kv BIL-100 Amp. continuous-current rating—50 MVA Int. Cap. at 14.4 kv.
O.C.R.
Standard-Duty type 3H three-phase recloser. 95 kv BIL-50 Amp. continuous-current rating—32.5 MVA Int. Cap. at 14.4 kv.
KYLE

Pole-mounted intermediate-duty Kyle reclosers are easy to operate. The operating lever is trip-free. It can be held in the closed position during tripping operation without recoil. Releasing the operating lever allows the recloser to lock out on a permanent fault. Operation counters are four-digit mechanical type mounted under the sleet hoods.

L-M Announces New Intermediate-Duty Kyle® Reclosers For Overcurrent Protection

New type 6H 3-phase reclosers incorporate all outstanding features of L-M's high-speed Kyle reclosers; available in 5 to 100 ampere ratings, 2.4 to 14.4 kv; symmetrical interrupting ratings to 3000 amps. Type 4H single-phase, intermediate-duty reclosers also available.

By **WILLIAM J. WEINFURT**
Chief Engineer
Kyle Products
Line Material Company

L-M's new type 4H single-phase and type 6H three-phase reclosers are self-contained, intermediate-duty units, designed to segregate permanent faults, and to clear transient or non-persistent faults on urban and rural distribution systems. They provide high-speed circuit clearing in less than 2 cycles with symmetrical RMS interrupting ratings up to 3000 amps. 4.8 kv and below, and 2000 amps. 14.4 kv.

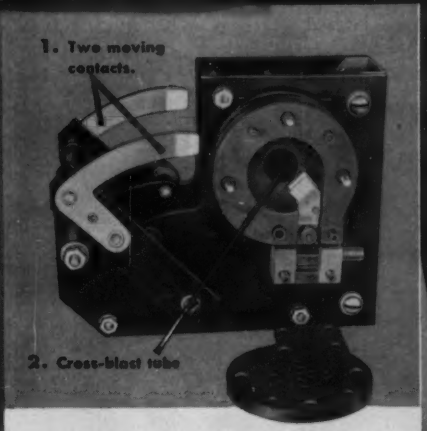
Retain Kyle Design

All the outstanding features of L-M's Kyle reclosers are incorporated in these new intermediate-duty reclosers. The timing mechanism is the service-proved Kyle hydraulic system with a selection of three time-current characteristics: Fast (A), Retarded (B), and Extra Retarded (C). Sequences can be easily adjusted for 2, 3, or 4 operations to lockout in any combination of operations. The type 6H provides single-phase tripping with operation counter for each phase, but lockout of one phase causes simultaneous lockout of all phases.

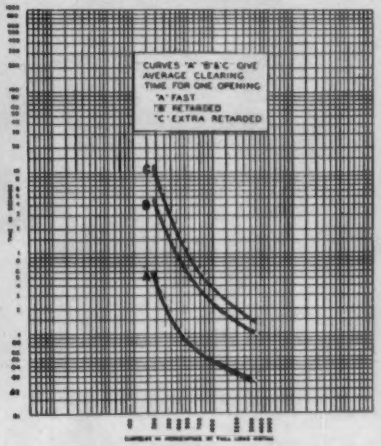
Contact Structure

Contacts and arc interrupter structure utilize the snap toggle contact action and cross-blast arc extinction principle. The cross-blast consists of two arcs drawn in series as the contacts part. Pressure

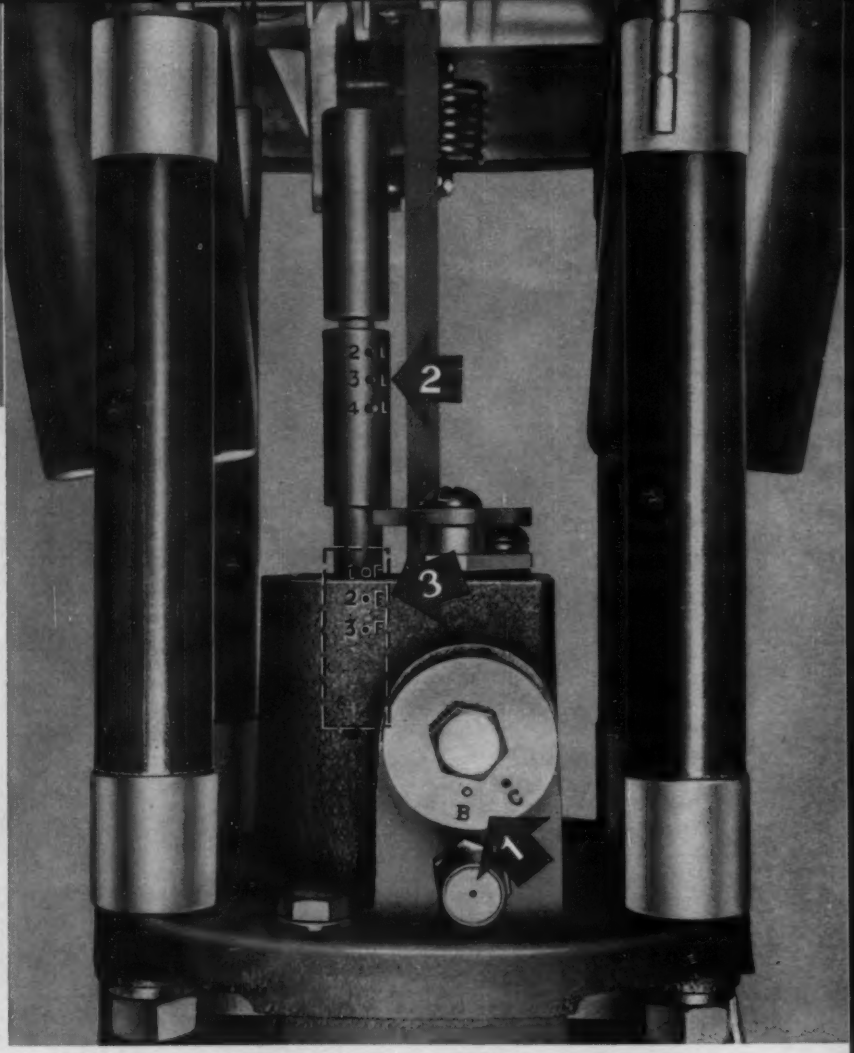
LINE MATERIAL
A McGRAW ELECTRIC COMPANY DIVISION



The new intermediate-duty reclosers utilize the service-proved cross-blast arc extinction principle. Two arcs in series are drawn as the contacts part **(1)**. Pressure generated by one arc forces oil into the path of the other arc, cooling it and extinguishing it rapidly. Note the long double-break **(2)** and cross-blast tube connecting the two interrupting chambers.



Time-Current Curves for series overcurrent tripping of L-M's intermediate-duty Kyle reclosers. Each phase of the type 6H trips individually until the final pre-selected operation, when all three phases lock open simultaneously.



Time-current characteristics and operating sequences can be easily adjusted in the field. Photo shows the hydraulic system of the type 6H recloser. Time-current characteristic is selected by moving disc to curve "B" or "C" **(1)**. Number of operations to lockout is selected by adjusting vertical extension of lockout piston **(2)**. Adjustment of sequences (number of fast and delayed operations) is obtained by the proper positioning of the roll pin located at **(3)**.

generated by one arc forces oil into the path of the other arc, cooling it and extinguishing it rapidly. Arcing time over the range of fault current ratings averages less than one-half cycle.

Moving contacts are silver-plated copper tungsten to reduce pitting and assure long life to the arcing surface. In operation, the moving contact wipes into the stationary contacts, thus insuring a cool, low-resistance, load-carrying contact. In addition, all current-carrying parts of the contacts are silver-plated.

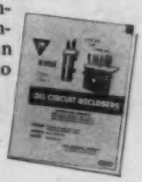
External Construction

Terminals are universal plated type and will accommodate either copper or aluminum from No. 6 solid through 250 MCM stranded in either a vertical or horizontal position.

Bushings are wet-process, 15 kv porcelain, externally clamped to head. Bushings have approximately 12″ creepage distance. The recloser will also be available with 15″ creepage-distance bushings where desired.

Get The Whole Story On L-M's Kyle Reclosers and Sectionalizers

L-M offers the most complete line of reclosers—single- and three-phase—from substation to load. Ask your L-M Field Engineer for information and bulletins on Kyle apparatus and complete coordination. Or write Line Material Company, Milwaukee 1, Wisconsin. In Canada: Canadian Line Materials, Ltd., Toronto 13, Ontario.



Kyle type 6H 3-phase reclosers available in normal load ratings

FROM 5 TO 100 AMPERES*

Ratings Amps.	Min. Trip Amps.	Inter. Ratings RMS Amperes 2.4-4.8 kv	Inter. Ratings RMS Amperes 14.4 kv
5	10	200	200
10	20	400	400
15	30	600	600
25	50	1000	1000
35	70	1400	1400
50	100	2000	2000
70	140	3000♯	2000
100	200	3000♯	2000

*Insulation Level: 110 kv BIL.

♯2,500 RMS amperes maximum Inter. rating at 8.32 kv.

Kyle® Reclosers

Standard® TRANSFORMERS

in good company

Standard Transformers have a reputation for keeping company in the best circles, both here and abroad. Standard designs and builds many of its transformers to meet specific requirements, incorporating those components specifically requested by the customer. These custom transformers cost no more than repetitive models and in many cases, because they are custom built, cut costs all the way along the line.

When you ask for bids, or when you place your next order for transformers, include Standard. You'll be following the lead of many outstanding power companies. If you have a specific transformer engineering problem, refer it to Standard. It will receive prompt attention.

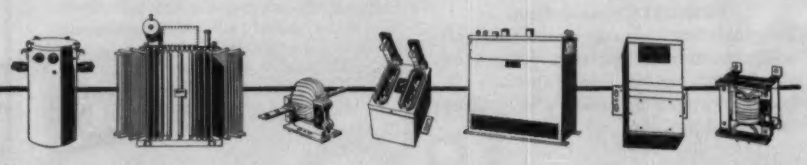
Standard®

THE STANDARD TRANSFORMER COMPANY

WARREN, OHIO • REPRESENTATIVES IN PRINCIPAL CITIES

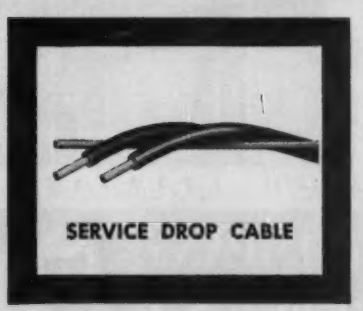
Transformers

FOR EVERY APPLICATION



GENERAL CABLE

ALECTRAL ALUMINUM CONDUCTORS



Consistent, outstanding performance mark General Cable's ALECTRAL Bare and Insulated aluminum conductors. Manufactured to General Cable's high standards in all sizes. Bare ACSR and aluminum • Weatherproof aluminum and ACSR conductors • All types of service drop cables. ALECTRAL is available with a complete range of paper, rubber and thermoplastic insulations, backed up by over 75 years of General Cable's engineering and manufacturing experience.

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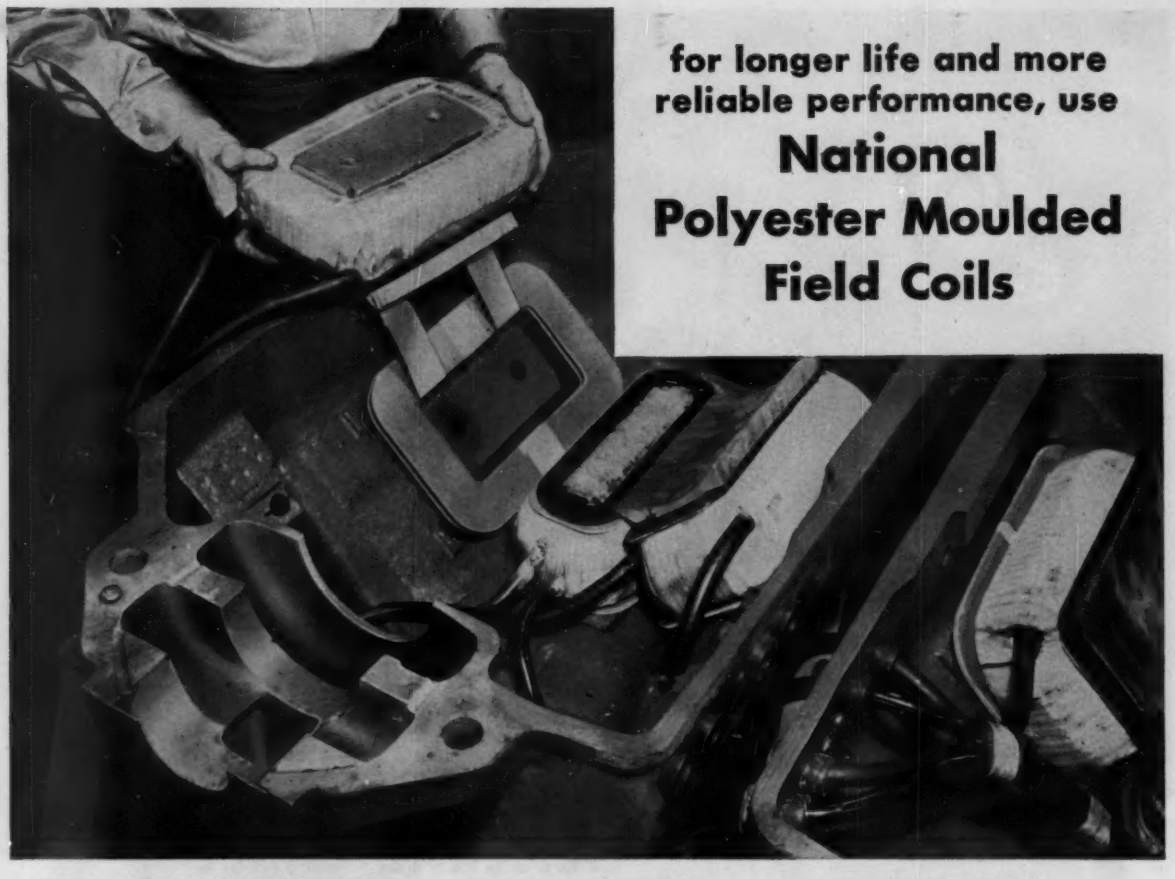
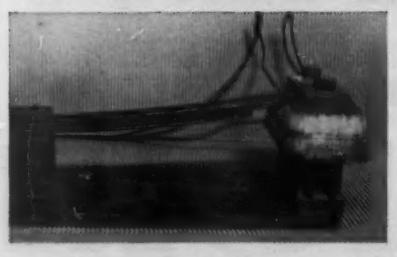
420 Lexington Avenue, New York 17, N. Y.
Offices and Distribution Centers Coast-to-Coast

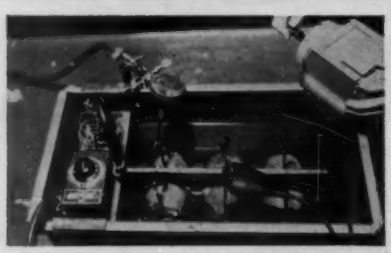
for quality and service . . . **specify GENERAL CABLE**



for longer life and more reliable performance, use

National Polyester Moulded Field Coils





INCREASED STRENGTH

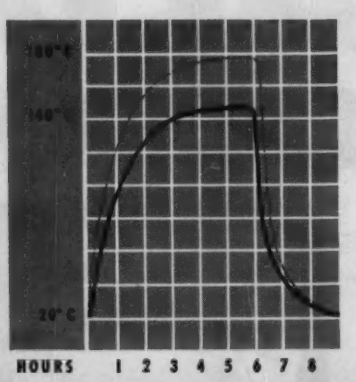
Complete polyester filling bonds all parts of the coil into a strong, unified, shock-resistant construction. The photograph at the left shows a shock test in which an energized and heated coil has been striking an anvil once a second for six months with no adverse effects.

GREATER RESISTANCE TO CORROSIVE ENVIRONMENTS

Complete polyester filling prevents penetration of moisture, oil, conducting dust, and other foreign matter that contribute to coil failures. The photograph at left shows a test in which National polyester coils were immersed successively in water, hot oil, and an iron filing solution. Periodic resistance tests show *no deterioration* of the insulation after several months submersion.

COOLER OPERATION

Absence of voids in the coil enhances heat transfer. The graph below shows comparative heating and cooling cycles for polyester-filled (solid line) and conventional varnish-treated (dotted line) field coils carrying the same amperage.



National polyester-filled field coils can be installed in National service shops or supplied for installation by your own motor maintenance crews. Call your nearby National field engineer or write for details.

NATIONAL ELECTRIC COIL COMPANY

COLUMBUS 16, OHIO, U. S. A.

ELECTRICAL ENGINEERS: MAKERS OF ELECTRICAL COILS AND INSULATION—REDESIGNING AND REPAIRING OF ROTATING ELECTRICAL MACHINES

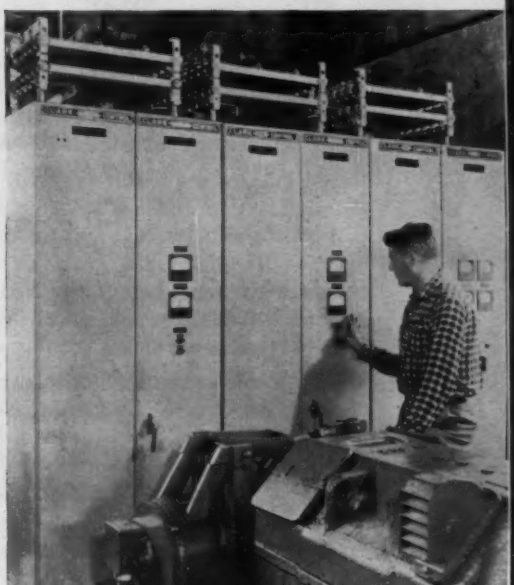
ONE MAN and CLARK CONTROL operate this giant unloader with capacity of 1100 tons per hr.

An average of 10,000 tons of coal per day is unloaded from river barges at the Ohio Valley Electric Corporation's Kyger Creek power plant, by two Heyl-Patterson rope-trolley unloaders. This plant and another like it at Clifty Creek are the largest privately-owned generating stations in the world—combined capacity 2,365,000 kw—supplying a total of 17 billion kilowatt hours per year for an Ohio atomic energy project.

Clark adjustable voltage control systems with magnetic amplifiers, team with Elliott rotating equipment in each unloader to provide maximum unloading rate, smooth acceleration and stopping, high efficiency, low maintenance and long rope life. One man controls the entire operation.

This is another example of greater operating efficiency through Clark-engineered Control. Let us help solve your control problems.

Clark control including magnetic amplifiers, located in motor room atop the tower, provides adjustable voltage control with current limit acceleration, deceleration and dynamic braking for the three drive motors. Note Clark edgewound resistors on top of the cabinet and Clark brake for the trolley motor in the foreground.



The CLARK CONTROLLER Company

Everything Under Control

1146 East 152nd Street • • Cleveland 10, Ohio

IN CANADA...CANADIAN CONTROLLERS, LIMITED • MAIN OFFICES AND PLANT, TORONTO

cordial customer convenience

The new REMINGTON RAND® Sectional Customer Service Counter is designed for combination of cashiering and bookkeeping. It offers custom-made beauty and efficiency without custom-made limitations—at a mass-production price.

Rapid face-to-face service to customers is provided. The counter is ideal height, and there is a continuous parcel shelf for resting packages or bundles. The working area side is compact without being crowded. Customer service and history records are within arm's reach in the Safe KARDEX® cabinets in the rear.

With complete facilities within arm's reach, clerks work comfortably seated, ending the usual "standing" counter cashiering—the fatigue and errors which result.

Certified, insulated pedestal units provide 24-hour, point-of-use protection against fire for vital records. Uninsulated pedestal units are available for records which can readily be duplicated. In larger offices, two or more units may be joined, providing any desired number of work stations.

See for yourself the many advantages of the Sectional Customer Service Counter. Send for our free booklet on the subject, SC764. You'll find it interesting and informative. Just write Room 1361, 315 Fourth Avenue, New York 10.

Remington Rand

DIVISION OF SPERRY RAND CORPORATION

New "Twist" in Arresters...

LONGER ARRESTER LIFE

It's the Westinghouse exclusive Mobilarc gap —employing a radically polarized ceramic permanent magnet. Applying the left-hand motor law, it spins or "twists" the arc around a longer path on the gap electrodes . . . No consequential pitting or plating, even with as many as 1300 surge and follow-current discharges or with long duration surge discharges . . . No deterioration of the gap or consequent lowering of 60-cycle spark-over. Tests indicate magnet life to be infinite.

You need such performance if you follow the trend to use arresters at 75% to 80% voltage ratings—to protect transformers against long duration switching surges as well as lightning. All Westinghouse SVS, SV, and LVS station and line type arresters are equipped with Mobilarc gaps—and there is no initial investment premium. Complete engineering details and ratings are available from your Westinghouse sales representative—or from Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pa.

J-60905

YOU CAN BE **SURE**...IF IT'S

Westinghouse

Here's how to save on a rainy day . . .

Work INDOORS on new Westinghouse OUTDOOR switchgear

The weather need no longer disrupt your maintenance schedules. In fact, you can *use* the rainy or snowy days to work on new Westinghouse Shelterfor-M* metalclad switchgear—and save the more pleasant days for regular exposed-to-conditions jobs.

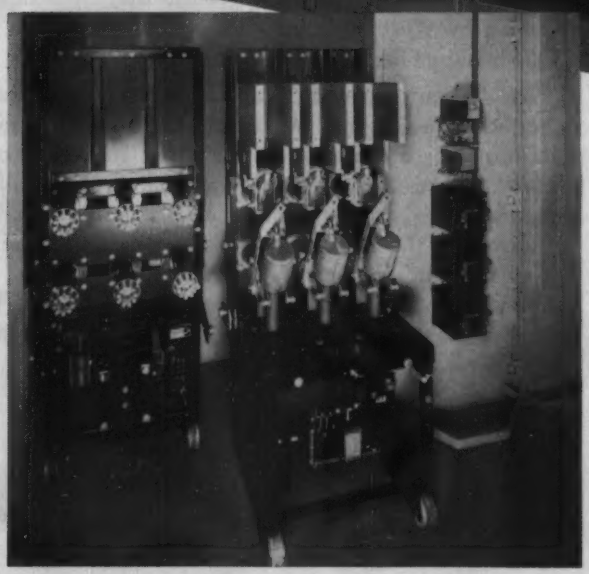
Westinghouse Shelterfor-M metalclad switchgear eliminates for all time the danger of rain or snow damaging breakers, instruments or relays. No more hanging canvas tarps—constructing makeshift shelters. Everything can be done from inside. Heating can be provided to eliminate the difficulty of working on super-chilled bare metal. In short, service is safe and comfortable in all weather conditions.

This new construction allows instrument panels to swing wide enough for front drawout of breakers for inspection and testing. There is room enough to pass two breakers side-by-side in the shelter even with the doors open wide.

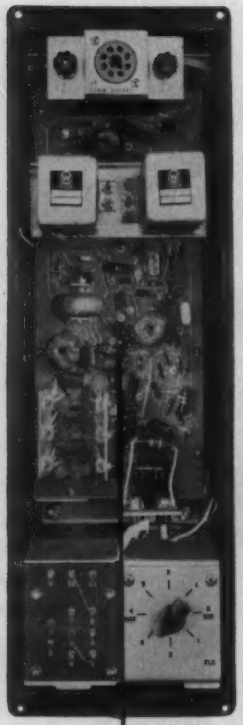
In addition, you get the other outstanding Westinghouse features such as . . . jig-welded construction, assuring interchangeability of like-rated breakers. Bonderized and multi-coat painting plus undercoating to eliminate rust and corrosion. Exclusive Redarta® insulation—the flame-retardant insulating material. Ask your Westinghouse sales representative for detailed information and prices, or write to Westinghouse Electric Corp., P. O. Box 868, Pittsburgh 30, Pa. J-60910

*Shelterfor-M—sheltered for maintenance

YOU CAN BE SURE...IF IT'S Westinghouse



The extensive shelter area permits moving breakers past one another even though the instrument panel is in full extended position.



Completely Transistorized Carrier

No tubes to stock

1/20 the space requirements

printed circuits

90% reduced battery power

MAXIMUM SYSTEM RELIABILITY

Completely Transistorized Westinghouse Carrier
field tested and proved
since 1954 by a large eastern utility

"Miracle" transistors could, but didn't "revolutionize" utility protective relaying practices—until they were applied to KR Carrier by Westinghouse in 1953—and tested and proved since 1954 in actual field service by an eastern utility.

In addition to the advantages listed above, the test and inspection schedule is greatly reduced. Maintenance drops to nearly nothing. The apparently infinite life of transistors means tops in reliable service. Inter-channel interference virtually disappears allowing more, fully reliable channels in the same band width. And you get the bonus of voice-communication for relay setup and adjustment in addition. All details, and field data, are available from your Westinghouse sales representative or from Westinghouse Electric Corporation, Carrier-Microwave Department, Box 7425, Halethorpe 27, Maryland. J-60903

YOU CAN BE SURE...IF IT'S

Westinghouse

"Babe, this here's a ree-tort," explained Paul Bunyan to his faithful Blue Ox. "Fer pressure treatin' wood. Them Baxter folks never dunk it, er spray it, er paint it. They got a real fancy process: They stick the wood inside this ree-tort, lock her up fer 20 hours, and when she comes out she's BAXCO pressure treated—chock full o' presarvatives." The great logger scratched his head with a pine tree. "I dunno how they do it, Babe, but them Baxter boys shore treat wood good—they make it last forever." ✻

BAXCO PRESSURE TREATED FOREST PRODUCTS

✻ Not quite *forever*, Paul—but wood, properly pressure treated, does last up to ten times longer. For maximum long-life protection against insects and rot, authorities agree that wood preservatives should be applied by pressure treating—and BAXCO Forest Products are *always* pressure treated. As West Coast pioneers in the wood preserving industry, our experienced engineering staff can assist in supplying you with the right preservative, the proper treatment, for any job. For a prompt quotation—inquire today.

Preservative treatments available: Creosote, Creosote-Petroleum solution, Creosote-Penta solution, Penta, Chemonite, Chromated-Zinc-Chloride, and Protexol fire retardants.

© J. H. Baxter & Co. 1956

J. H. BAXTER & CO. *120 Montgomery Street, San Francisco 4, California*

Patent Applied For

Moloney HyperCore Distribution Transformers

Each and every HyperCore Distribution Transformer shipped from Moloney's new, enlarged, streamlined facilities will perform, without exception, as NEMA Standards prescribe! Elaborate test facilities maintained by many utilities are now unnecessary for HyperCore Transformers, because this new manufacturing system eliminates any possibility of shipment of sub-standard transformers. Case histories of *each* individual transformer are kept and *each* transformer must measure up to NEMA Standards and Moloney's own high standards before it can be crated for shipment.

For example—When final assembly is completed, the automatic test system takes over. *Every* transformer must pass the following tests: Copper Loss Test • Ratio Test • Impulse Test • Induced Potential Test • Applied Potential Test • Core Loss Test • Sound Test • CSP Breaker Test (when applicable) • Leak Test.

All these vital tests are made *automatically* by remote control from the master control room. It is impossible for the human element to influence tests.

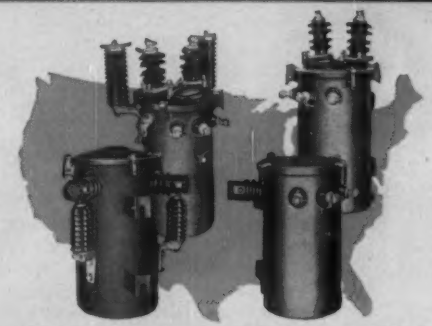
M O L O N E Y E L E C T R I C C O M P A N Y

Automatic spotting devices mark any sub-standard transformer not meeting Moloney's high standards, and direct it into a reject line, where it is removed and examined to determine the reason for failure.

Thus, any HyperCore Transformer that is shipped, *automatically* performs as you, the utility, and we, the manufacturer, want it to perform.

Increased production facilities, plus positive quality control, plus the Moloney network of warehousing facilities, make available the best product . . . at the time you need it. Immediate shipment from stock can be made from a point near you. Check with your Moloney man today.

ME87-6



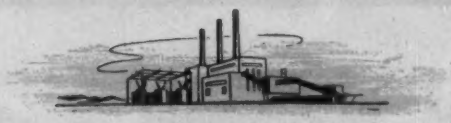
HyperCore Transformers are available from stock in all Standard Ratings in both Conventional and CSP designs.

MOLONEY ELECTRIC

Manufacturers of Transformers for Utilities, Industry, and Electronic Applications

SALES OFFICES IN ALL PRINCIPAL CITIES • FACTORIES AT ST. LOUIS 20, MO. AND TORONTO, ONT., CANADA

Human history is in essence a history of ideas* *H. G. Wells 1895



Thomas Alva Edison

Harnessing electrical energy was his fixed idea At 27 he had invented the world's first incandescent lamp. Edison, a practical genius, inspired his team with enthusiasm. In the ensuing 57 years of his life he led them to find more ways to make electricity produce sound, light, motive power and heat —with more ideas than any other man of his time.

The Kerite Company was established when Edison was but eight years old. By the time his inventions were ready to add to America's prosperity, Kerite craftsmen had acquired more than a generation of cable-making "know-how." The newly formed utility and railroad companies of the 1870's relied then, as do their successors today, on the unfailing service and long life of Kerite cable.

As power loads increase year by year, the inherited integrity and skill of today's Kerite craftsmen insure that the demands of far-sighted utility, industrial and railroad engineers will be amply fulfilled in the years ahead.

The value and service life of a product can be no greater than the integrity and craftsmanship of its maker.

KERITE CABLE

Founded 1854

THE KERITE COMPANY—30 Church St., New York 7, N. Y.
Offices also at 122 S. Michigan Ave., Chicago; 582 Market St., San Francisco;
3901 San Fernando Rd., Glendale 4, Calif.; 31 St. James Ave., Boston;
4101 San Jacinto, Houston 4, Texas; 1010 Euclid Avenue, Cleveland 17, Ohio;
29 West Lancaster Avenue, Ardmore, Pa.

EDITORIALS

Let's Re-Examine Turbine-Generator Standards

Standardization of turbine-generators today appears to be in the doldrums. Certainly it is not maintaining the pace or living up to the objectives foreseen for it when the ASME-AIEE preferred standards were adopted in 1945.

The time seems ripe to review turbine-generator developments of recent years and weigh the advantages to be gained from bringing existing standards into closer agreement with present practice.

Demand for larger and larger turbine-generators has accelerated rapidly in the past ten years. The size of machines today is fast out-running the 150-Mw unit which is the largest on the prevailing standard list. However, there are a substantial number of machines rated 200, 275, 300 and even two 450-Mw units being built today. But there is still little immediate indication of a similar upward trend in the rating of standard turbine-generator units.

Generator design and construction too has changed rapidly in the last few years. Forced cooling of rotors and stators, for example, is no longer solely applied to the higher-rated units but has been spreading to smaller machines—some within the scope of the prevailing turbine-generator standards. While it may be too early to standardize on the details of forced-cooled units, it should be possible to establish a basis for standardizing their ratings.

Cross compounding in the larger machine sizes and the attendant use of identically rated 3,600-rpm machines have been a direct out-growth of the demand for and the economics of large units. As this demand continues, it would appear that opportunities for cost savings through building block combinations of standard machines should be an added incentive for standardization. Certainly studious examination of the possibilities for savings through standardization in this area would be worth while at this time.

It might be argued that technological progress in the past ten years has been too rapid for the orderly and studious process of standardization. It is certainly true that turbine-generator standardization has a long way to go to catch up with current requirements. It would appear that early measures should be taken to close the widening gap.

Humidity Control: An Air Conditioning Opportunity

The use of air conditioning equipment in the average home today can be increased some 1,500 hours each year and its energy consumption 1,200 kilowatt hours without adding a single kilowatt to the peak load. This may seem surprising. But it is an entirely practical fact and could be realized if air conditioning equipment provided humidity control independent of cooling. It takes a look at the facts to realize how this can come about.

In the first place, 100% air conditioning—technically—involves all these: Heating and cooling, adding and removing moisture, filtering of particles, control of vapors and odors, and the regulation of air circulation. What passes for air conditioning today falls short of this. It is seldom that more than temperature control is done completely, let alone the other requirements. Dehumidification is provided only as a by-product of cooling.

Moreover, today most package-type air conditioning units fail to control humidity during the moderate and cooler hours when, although it is humid, cooling is not needed. The reason is that present equipment does not dehumidify air without cooling it. However, humidity control frequently is more important to comfort than temperature reduction, particularly during sleeping hours.

Including this extra comfort service in modern air conditioning would not only meet a consumer need but also help solve the utility air conditioning problem. The extra 1,500 hours during which air conditioning would be useful and the resulting 1,200 kwhr increased energy consumption would probably add 8 to 10 percentage points to annual load factor of residential air conditioning over most of the country, again without increasing peak load.

Adding humidity control to air conditioning would require some changes in the "cooling-only" facilities. But it could be done by first "over-cooling" and then whenever necessary restoring the heat of compression or adding other heat to maintain the desired relative humidity.

As we see it, here is a fine opportunity for utilities and manufacturers to promote the idea of humidity control and perfect the equipment that provides it.

Sharpening Thermal Economy

. . . of nuclear reactors will be goal of 12 Ohio Valley utilities in research and development probe. Program may lead to 200-Mw plant by 1965

A group of East-Central utilities have announced their intentions to tackle a $15- to $31-million reactor research and development program leading ultimately to construction of a commercial nuclear power plant that may develop 200 Mw.

Participants are American Gas & Electric Service Corp, Cleveland Electric Illuminating Co, Columbus & Southern Ohio Electric Co, Dayton Power & Light Co, Indianapolis Power & Light Co, Louisville Gas & Electric Co, Monongahela Power Co, Potomac Edison Co, West Penn Power Co, Ohio Edison Co, Pennsylvania Power Co, and Southern Indiana Gas & Electric Co.

Philip Sporn, chairman of the group's working committee, said the group intends to stress improvement in thermal economy and reduction in reactor size per kw "as one of the surest roads to lower capital costs."

To achieve this, the group first is to build a prototype having a heat output of about 50 Mw (equivalent to about 13 electrical Mw). But at the moment, Sporn said, the group has not decided whether it would be worthwhile to add a turbine.

The prototype should be finished by 1961, he said. If all goes well, plans for construction and operation of a full-scale reactor will begin well before 1962. The commercial reactor should be operating by 1965.

Three reactor types are now being considered. They are:

- A graphite-suspension reactor with ceramic fuel elements.
- A liquid-metal-cooled, natural uranium, heavy-water-moderated reactor.
- An advanced type sodium-cooled, graphite-moderated reactor with ceramic fuel elements.

Sporn said the group will draw up a formal proposal for the AEC, after evaluating the reactor types. The proposal will contemplate that AEC participate in the project and share in its costs and benefits.

Organic-Moderated Reactor Being Built

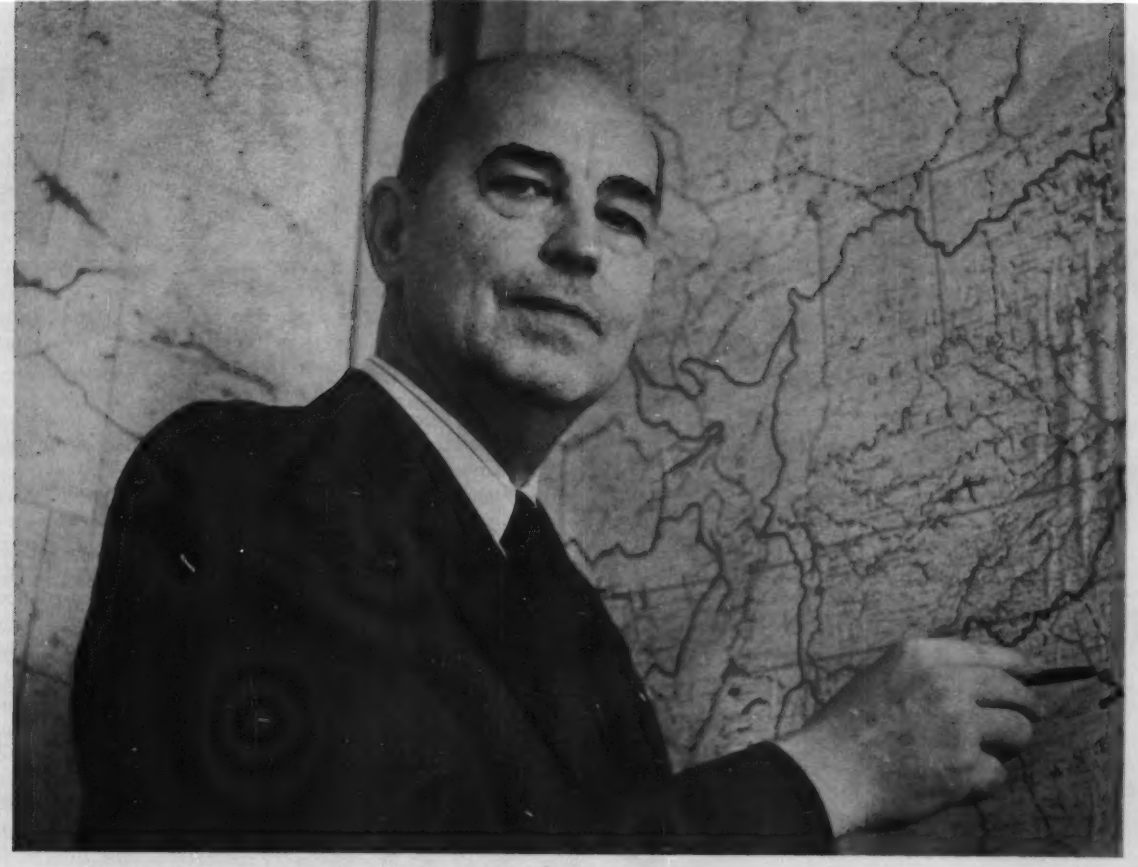
Induction heating coils are being installed here on the bottom of the main core vessel which will be used in the Organic-Moderated Reactor Experiment at the Atomic Energy Commission's National Reactor Testing Station, Arco, Idaho. The experimental nuclear power reactor is being built by Atomics International, a division of North American Aviation, Inc. The experiment forms part of the AEC's program aimed at developing economical power from nuclear energy. Construction of this facility is expected to be completed this year.

NUCLEAR NOTES

Pacific Power & Light Co says Washington Water Power Co, Portland General Electric Co, and Montana Power Co have indicated an interest in atomic power possibilities and that all or part of this group might participate in future construction of an atomic plant on 14 sq mi of land Pacific P&L recently acquired near AEC's Hanford works.

Consumers Public Power District will start its new 75-Mw sodium graphite reactor atomic plant at Hallam, Neb., with a conventional boiler and switch to atomic power when the reactor is complete. CPPD advertised for bids on turbine with basic design, 1,450 psi/1,000F with provisions to operate at 850 psi/950F. "In this way," they say, "we can proceed to get firm power supply and maintain flexibility for reactor operation when the contract with AEC is completed and work is done."

"On the basis of our known ore reserves . . . today I would not trade the uranium resources of the U. S. for those of any other country," asserts Jesse E. Johnson, director of AEC's Raw Materials Division.



In exclusive interview, TVA Chairman Vogel answers . . .

What's Ahead for TVA?

Tennessee Valley Authority operates an electric power producing system with an installed capacity of 9.6 million kw. Its transmission system of 10,200 circuit miles covers most of Tennessee and reaches into six other states. Total agency employment runs around 14,700 persons.

Setting policy for this huge resource development authority is a three-man board headed by Chairman Herbert D. Vogel, a retired brigadier general in the Corps of Army Engineers and a hydraulic engineering expert. Vogel, who was appointed to the position August 1954, is the first and, at present, the only TVA director appointed by a Republican president during the agency's 23-year history.

In his warmly candid manner, Vogel here details his aspirations and future plans for one of the nation's most imposing power systems:

Question: General Vogel, a vacancy will occur on the three-man TVA Board in May. Would there be a substantial policy change if the new member should be more susceptible to your views than the current members are?

General Vogel: I doubt there would be a really substantial change in policy. That is pretty well set forth under the basic (TVA) legislative Act. I do believe we might well adopt more business-like procedures in the management of our organization. A tighter, more efficient organization could be built. Some of the executive responsibilities which now fall to the general manager might be more equitably shared. And I would like to see a new headquarters building erected in Knoxville, instead of at Muscle Shoals.

Q: You mention that executive responsibilities might be more equitably shared . . .

Vogel: Right now some 13 organizational units report to the general manager. That's just too many—there should be no more than seven at the very most. Staff and operational functions should be more clearly

separated. Also, I believe the board of directors might take a more active part in administering and following up the work of the agency.

Q: You and the present Administration have from time to time been accused of trying to throttle TVA. What do you have to say about that?

Vogel: It seems to me that kind of accusation is patently false. In the two and a half years since I have been here our power capacity has jumped nearly 3½ million kw. This amounts to the most rapid growth ever experienced by any power system, and the end is not in sight. Does that sound like we have been throttling the growth of the agency?

Q: You don't expect TVA's capacity to keep growing at that rate, do you?

Vogel: Certainly we don't anticipate it in the near future. A great deal of the present capacity was built to serve the Atomic Energy Commission loads. At the moment, those seem about taken care of. But I do want to emphasize that as a part of growing America, no obstacle to growth should be placed against this area. As an arsenal of the nation, its potentialities must not be diminished.

Q: What kind of growth are you expecting?

Vogel: During the next few years it appears that about 800,000 kw of generating capacity must be added annually to meet the growing residential, industrial and commercial loads in the area we serve.

Q: This year you are financing most of your expansion out of current revenues. How much longer can you do that?

Vogel: Not very long. No utility can be expected to finance any appreciable expansion for any length of time out of current revenues. TVA's present capability results from the fact that we are ahead of schedule in our payments to the Treasury and are, therefore, able to devote revenues to this purpose. That, however, is a temporary condition, and for the long pull our power system, like any utility, must have sources of new capital for the purpose of expansion. In the past that capital has been provided through appropriations. Now, however, Congress has indicated an unwillingness to provide continuing appropriations to finance this expansion.

Q: And that is why you are looking to the revenue bond method of financing your expansion?

Vogel: That seems the most feasible method of financing expansion within our area. President Eisenhower has, in three successive budget messages, urged that Congress approve the use of revenue bonds for expanding our generating facilities. Further, it is an accepted way of doing business, and it would eliminate the need for appropriations.

Q: What are the main hitches in working out revenue bond legislation?

Vogel: There is general agreement on the revenue bond approach. The details are giving us the trouble. Such things as paying interest to the U. S. Government on appropriated funds already invested in the power system, the rate of payment to the Treasury from power earnings, and the interest rates to be charged find varying acceptance. It seems to me that these problems can be resolved on the basis that TVA should operate as a sound business, within the limits of its statutory charter, subject to the restraints and privileges of private industry.

Q: Revenue bond financing would seem to make TVA pretty much of a free agent with little or no dependence on Congress?

Vogel: Not at all. TVA recognizes its responsibility to Congress and to the Executive Branch of the Government. However, one of the most difficult policy problems connected with instituting revenue bond financing is that of preserving the form and substance of Presidential and Congressional control of policies of the TVA Board and, at the same time, assure that the Board has the authority to discharge its responsibilities under the Act.

Q: But how would you retain those controls and still have TVA responsible for backing its bonds?

Vogel: The best approach, in my opinion, would be to assess the several responsibilities of the Executive Office of the President, the Congress, and the TVA Board. All have responsibilities to be sure, and each should be provided with commensurate authority to meet them. No one can argue with the principle that responsibility and authority should be commensurate.

Q: And how far along are you toward getting the kind of bond legislation you need?

Vogel: The matter is receiving continuing attention. I would say that we will need some enabling legislation this year if we are to go forward in meeting our power obligations after the winter of 1960-61.

Q: Would changes in the basic TVA Act be necessary to permit revenue bond financing?

Vogel: Any form of a financing bill would probably have the effect of amending the basic Act and would bear on previous amendments. I doubt that it would have any effect, however, on the basic principles.

Q: Once you get revenue bond financing, would you see any chance of expanding TVA's service area—the geographical limits of the agency?

Vogel: The importance of revenue bond financing relates to the need for additional generating capacity to supply the demand for electricity in TVA's present power service area—not to provide capacity for the expansion of that area. There is no desire to expand the area of responsibility.

Q: Do you believe other areas—other basins—might benefit from the TVA form of resource development?

Vogel: I think this authority makes its maximum contribution as a unique proving-ground for various

political football . . ."

types of resource develpment. Certainly we have set examples of which we are all proud. But I believe the creation of a whole series of such authorities over the country might present a danger of changing the basic form of our executive branch of the Government, or at least diminishing its responsibilities as exercised through existing agencies. I think there is a vital need for an overall coordination of the various phases of development and conservation which are undertaken cooperatively by the Federal Government, the States and local interests. The problems of each river basin should be completely integrated, but priorities among the several basins should be appraised on a national basis.

Q: Here in the Valley, do you think TVA has sometimes stressed power development at the expense of other phases of resource development?

Vogel: As you know, the primary purpose of the authority was to provide flood control and navigation along the Tennessee and its tributaries. Sometimes the power operations have overshadowed the more basic purposes. But floods, such as we have had in recent weeks, again draw attention to the vital role of flood control in our operations.

Q: Do you think that the City of Memphis, in building its own power supply, is setting an example that will be followed by other large cities in the Valley?

Vogel: That is a matter for each city to decide for itself. It is important, however, to bear in mind that many of the economies achieved and reflected in the rates now available to the distributors of TVA power result from the operation of a large, integrated system. TVA, of course, wouldn't stand in the way of a city's decision. We would be glad to work out an exchange agreement if we could do so in a way that would not penalize our operations.

Q: And a personal question, what do you find most irritating in your job?

Vogel: What gripes me most is to see someone attempting to use TVA as a political device to further his own personal aims. I think it is a mistake to try to make TVA a political football. It doesn't help the agency and it doesn't help the people served by the agency.

Q: TVA seems most of the time to have sort of stood by itself in the industry. Do you see a chance of breaking down some of the barriers that have isolated it?

Vogel: I most certainly look to the day when we can dispel some of the mutual suspicion that has existed between the Authority and other segments of the electrical industry. At the operating level, I think we have come along pretty well. Our engineers participate in society meetings. Our exchange agreements with neighboring utilities have worked smoothly and well. I would like for the executives of other electric utilitites to know that we have no secrets here. We would welcome any exchange of information and visits that would be mutually helpful.

"We agree generally on the revenue bond approach. The details are giving us the trouble . . ."

"Does that sound like we have been throttling the growth of the agency? . . ."

"I would like for the executives of other utilities to know that we have no secrets here . . ."

McGraw-Edison Co. photo

"HOME IN THE CLOUDS" gave visitors to Cincinnati's Electric Living Exposition lofty LBE goal. Three couples won prize of high-flying electrical living here for three days each. They also got $1,000 worth of appliances. Made of transparent plastic and aluminum, home was equipped with elevator, intercom, TV. More than 75,000 attended the show

Second Electrical Week Has "Bang"

• Early reports show promotion effort had finesse of long-standing programs, despite this observance's tender age. Estimates on NEW exposures: 115-million magazine readers, 95-million video viewers

As these photos show, National Electrical Week was promoted in diversified style during its Feb. 11-16 life. Based on preliminary reports of local activities and national advertising, the second country-wide observance packed a wallop that suggested seasoned maturity for this 2-year-old undertaking.

The ground work of local committees in small towns and cities stands out as one of the important highlights. Robert E. Hillard, NEW committee liaison man, said that 400 communities ordered promotion materials. "I'm hopeful, naturally, that all of them will send us a report on their activities," he said. More than one-fourth of them had reported by Feb. 21.

According to Hillard's preliminary findings, here is the scorecard:

• National Advertising—Pulse ratings on television shows came up with a figure of 94,648,650 viewers. About 115 million magazine readers were exposed to NEW ads in major magazines.

• Ten states issued proclamations.

• Orders for 43 local TV commercial film clips were received.

• Live Better . . . Electrically offices filled requests for 145,602 copies of "Step-By-Step Ideas to Live Better Electrically."

• Fifteen major metropolitan newspapers had special sections.

• More than 1-million copies of "Electricity in Your Home," a home inspection folder, were delivered by the central printer. Other copies were printed locally. Most of the folders were distributed to secondary school students.

This partial picture will be filled in for presentation to the national NEW committee later this month.

On the local scene, committees generally followed a tried-and-true pattern. A kick-off meeting of business, civic, school, and government people provided avenues for publicity and proclamations. Speakers from the electrical field handled many of the educational facets in talks at schools and club meetings. Radio spots and newspaper ads featured the observance.

Some cities injected other attention getters. To name a few:

Philadelphia put most of its NEW eggs in a Home Show basket that drew 450,000. Kicked off with an LBE caravan parade, the show was "terrific," said Milt Allen, vice president, sales, Philadelphia Electric Co. The utility had 28 men at their prize-winning exhibit and nine others staffing a restaurant display.

Cincinnati, sparked by the promotion-minded Cincinnati Gas & Electric Co, staged a week-long program. Focal point was the Electric Living Exposition with its Home in the Clouds. More than 75,000 people looked over displays of 125 exhibitors. All three newspapers ran special sections. The city's three TV

McGraw-Edison Co photo

PLANT TOURS for honor students were among Southern California Edison Co's NEW activities. Power Consultant Ken Carlson compares Edison's lamp and 1000-w bulb

DEDICATING EDISON HOME in West Orange, N. J., are C. L. Wirths, National Park Service; Edison's son and daughter, Mrs. J. E. Sloane and former Gov Charles Edison

stations gave plaques to their choice of the "Most Electrifying Personality." And a public library exhibit, news items, editorials, and dealer displays added frosting to the observance fare.

Los Angeles—Selling high school youths on engineering careers was the point of emphasis by California Southland utilities. Institutional films, illustrated talks, and plant tours for junior and senior high students were among methods used to describe the industry's potential.

St. Louis—Union Electric Co President J. W. McAfee spoke to the city's Board of Trade's opening-day luncheon. A newspaper section, distribution of 200,000 home inspection folders, and a state-wide proclamation were other highlights. Merrill Skinner, national NEW committee chairman, saluted the observance on Union Electric's monthly TV spectacular.

Skinner, vice president in charge of sales for the utility, stressed the importance of NEW as "a logical beginning of the year push." He told the Electric Institute of Washington, D. C., the observance provides a national focal point for national programs such as Live Better . . . Electrically and Housepower.

Manufacturers promoted the Week in varying degrees. The national committee had counted about 45 that planned to take part. Westinghouse Electric Corp, for one, estimated that its TV, radio and magazine messages reached 58 million persons.

MISS AC AND DC brightened Los Angeles observances. Employees of Dept of Water & Power, they are joined here by Mayor Paulson, left, and Glenn Logan, league manager

MISSOURI PROCLAMATION is signed by Gov James Blair, Jr. From left league officials Les Barrett, John McDermott; NEW Chairman Skinner; Missouri P&L Pres Davis Benning

Rules Proposed for Future Reactor Pacts

Ground rules for future contracts between Atomic Energy Commission and industry for demonstration atomic power reactor projects have been laid out by U. S. Comptroller General Joseph Campbell.

These rules are in the form of recommendations to the Congressional Joint Committee on Atomic Energy and stem from criticism of AEC's contract with Yankee Atomic Electric Co.

Campbell noted that since this was the first contract signed under the Power Demonstration Reactor Program and may be used as a guide in future negotiations, AEC should consider adopting the following recommendations:

1. Financial Competence—When the contracting party has sponsoring members as in Yankee's case, AEC should require binding agreements from sponsors covering their financial contributions prior to signing the contract with AEC.

2. Abandonment of the project—When the contracting party has sponsoring members, AEC should obtain from the sponsors a guarantee that the applicant will perform the work proposed.

3. Accuracy of cost and other financial data—AEC should obtain the right to audit all transactions related to the contract.

Campbell told chairman Carl T. Durham of the joint committee that AEC had informed him that it intends to adopt these recommendations on pending and future contract negotiations.

Campbell said the 12 utilities owning Yankee had not yet executed binding agreements with Yankee covering their proposed capital contributions and their purchase of power to be produced by Yankee. Therefore, "Yankee has not demonstrated its financial competence," and AEC executed the contract without knowing whether the government will get ample benefits.

Campbell claimed neither Yankee nor its 12 sponsors has given contractual assurances that Yankee will perform the work contracted for.

AEC responded by saying that in view of the substantial amounts of money the companies would have invested in the project it did not believe a decision to abandon the project would be taken lightly.

WASHINGTON COMMENT

Congress Unit Asks: Is Private Reactor Program Adequate?

V CRAIG RICHTER, Washington Correspondent

The eagerly awaited hearings on the status of the civilian atom industry which opened before the Joint Congressional Committee on Atomic Energy Feb. 19 are forcing certain atomic facts of life to the fore:

- Building atomic power plants is a lot more costly than was expected.
- Some of the problems encountered are a lot tougher than expected.
- Private industry will have to come up with a big program or the federal government will go into the reactor building business.

These hearings, required each year under the Atomic Energy Act, are designed to survey the status of the entire industry, not merely the progress in power reactors. In fact, it was specifically stated this year that reactor acceleration and federal liability insurance would only be dealt with briefly because they would be the subject of more detailed hearings later.

Yet the question of reactor acceleration underlies much of what is happening. It is evident in many of the questions directed to witnesses.

The nub of the issue was exposed at the outset of the hearing. Following the glowing report on power reactor progress by AEC Chairman Lewis L. Strauss, one of his own commissioners, Thomas E. Murray, publicly disagreed with him.

Murray argues that industry could not be expected to support an effort beyond that required to meet its own needs on its own time schedule. But the time schedule required by national interest is much shorter.

He contends there is evidence that industry has come to realize that there has been too much salesmanship and not enough engineering in nuclear power.

Murray suggests a two-phase program: (1) During the short-term phase, construction by the government of four specific types of reactors at AEC installations with AEC using the power. These types are ones which can be made to operate successfully as large-scale projects. (2) During the long-term phase, industry would accept the responsibility of developing reactors to meet this nation's needs.

Murray's stand is supported by the Democratic members of the committee. Sen John Pastore (D-R. I.) promises to ask Strauss back to the stand to find out just why a program such as Murray proposed could not be carried out.

And Sen Albert Gore (D-Tenn.), sponsor of the bill this year and last to have let the government spend $400 million building reactors, says flatly that the present reactor program is "utterly inadequate."

Democratic questioning of Strauss in the hearings indicated they want to establish that original completion dates for power reactor projects either could not or are not being met and that original cost estimates were out of line. They also dug into precisely what financial assistance AEC is offering on industry projects and into Strauss' statistics—his list of reactor projects—for whatever flaws they could find.

Going Up: A-Power Prices

Atomic power plant cost estimates already are proving to be too low. As reported last week, Shippingport will cost $55 million, which is $18 million more than expected. This week, at the Joint Committee on Atomic Energy hearings, Consolidated Edison Co of New York, Inc, said design changes and an increase in ultimate capability had pushed total costs of its proposed power reactor plant from $55 million to $70 million. (Capacity is being boosted from 236 Mw to 275 Mw).

Yankee Atomic Electric is having the same trouble. Costs are up "substantially" over the original estimate of $35 million, it said. Signs now point toward power costs of 12 to 14 mills per kwhr instead of 10 to 12 mills as hoped.

Geo-Sonic Power

Russia's scientific plans for 1957 include tapping the earth's heat for generation of electric power. The newspaper "Soviet Aviation" said the first "geo-sonic" power stations would be built in Siberia's Kamchatka peninsula and adjacent Kurile Islands because volcanic activity there is close to the earth's surface. But no technical details were revealed.

Cross-Arms vs Olympics

A Seattle, Wash., home-owner has won a lawsuit against Seattle Dept of Lighting on grounds that a cross-arm projected over his property, obstructing his view of Puget Sound and the Olympic Mountains. Superior Court Judge James W. Hodson ruled that the projection of cross-arm and wires constituted trespass. He awarded the home-owner $1 for each day since Sept. 19, 1953, the date of the cross-arm's erection.

St. Lawrence Pacts OK'd

New York State Gov Averell Harriman has approved a contract granting 115,000 kw a year of St. Lawrence power to Niagara Mohawk Power Corp. In addition, NMP will get "all residual power not required by the Authority for its other customers." The governor also approved a contract which allots annually 200,000 kw of firm power and 39,000 kw of interruptible power to Reynolds Metal Co.

The approved NMP contract (1) changes the formula for figuring savings to domestic and rural customers—saving them an estimated 10% more, (2) gives the Authority the right to approve the manner in which savings are passed on to consumers, and (3) specifies that power sold will be available for merger later with power generated from the proposed Niagara River project.

Execution of the two contracts—estimated to bring the N. Y. Power Authority $24 million a year in revenue—is said to guarantee the financial success of the hydroelectric project. Schedules call for first power generation to begin in 1958, and all construction to be finished by '59.

Load Grows in Ohio

Ohio Power's Kammer Station, still unfinished, already has been expanded to accommodate rapidly growing industrial power demands. Under the original plan, Ohio Power was to install and operate two generators—one owned by the utility and the other owned by Olin Revere Metals Corp (EW, Jan. 30, 1956, p 9). Now the company plans to add a third generator to be owned by Olin Revere. This will raise Kammer's capacity to 675 Mw.

Meanwhile Ohio Ferro-Alloys Corp announced that it will build a $3-million plant next to the Kammer station. High-tension lines will feed the plant's three huge electric furnaces directly from Kammer. With an eye to the future, Ohio Ferro-Alloys also has designed the new plant so it can be tripled in size if necessary.

Kammer's first unit is slated for operation next January, and all three units should be running by the end of September.

23-Head Decisions

Byron Price, an Eisenhower-appointed assistant to Bonneville Power Administrator William A. Pearl, said recently that when BPA administrative reins passed from Paul Raver to Pearl in January, 1954, it was "almost impossible" to fix responsibility for major decisions involving BPA. Under Raver, he said, major decisions called for consultation with 23 men. Meanwhile Raver, now superintendent of the municipal system in Seattle, Wash., said, "The record of the Bonneville Power Administration speaks for itself. I have no desire to be drawn into any controversy with Mr Price about it."

Bad Program?

A 21-in. television picture tube exploded in a house 10 miles east of Louisville, Ky., recently, showering the room with glass and wreaking an estimated $3,000 to $4,000 damage to three rooms and the bath. The owner and his wife were watching the set, which had been returned from the repair shop that day. Last year, a house burned down in Prospect, Ky., when a TV picture tube burst.

For Good Lighting Jobs: $5,400 in Rewards

Electrical World joins in sponsoring International Lighting Competition, open to personnel of utilities, contractors, distributors, and design firms

This year's International Lighting Competition gets under way March 15, holding out $5,400 as prize-awards for good lighting jobs done last year and this year.

The contest is sponsored by Electrical World, Electrical Construction & Maintenance, and Electrical Wholesaling, all McGraw-Hill business papers, in cooperation with the National Lighting Bureau of National Electrical Manufacturers Assn. The contest is for individuals rather than companies.

Its four divisions are open to any person who may be owner, manager, or an employee of: (1) electrical contractors, (2) electrical wholesale distributors, (3) architect or engineering firms, or (4) electric utilities. Joint entries are permitted.

These are the six classifications of eligible lighting jobs:

1. Industrial—Factory, warehouse, production and assembly area, garage, repair shop, storage area, and protective lighting.

2. Store—Interior sales areas, including such service areas as restaurants, barber and beauty shops.

3. Office—Interior lighting of offices, conference rooms, banks, lobbies, reception rooms, and similar areas.

4. Institutional—Interior lighting of schools (classrooms, play and service areas), hospitals, museums, churches, and the like.

5. Outdoor—Street and highway lighting, and such installations as monumental, recreational, spectacular, protective, and other utilitarian and decorative floodlighting.

6. Residential—Lighting of an entire house or any part of it, including exterior and garden.

Contestants must mail applications by Oct. 25 (see contest announcement on page 124).

Any lighting job completed between Jan. 1, 1956, and the contest's closing date is eligible. Winners are to be announced during the week of Nov. 11, 1957.

Entries in the first four classifications listed above meeting the standards set by the National Lighting Bureau will be certified.

A total of 120 cash prizes is being offered. Five cash prizes in each of the six installation classifications will be offered in the four contest divisions. First prize will be $100. Second will be $50. There will be three third prizes of $25 each.

Entries will be sifted by a board of judges prominent in the various lighting fields. They will consider sales effort, lighting adequacy, artistic or aesthetic appearance, and customer benefits.

All judging will be done without names of contestants or identification of entries being known to judges. Each entry will bear a registration number for identification. No entry will be accepted for judging that does not bear this assigned registration number. All entries will be submitted to the judges in identical form in folders supplied for that purpose.

Contest's objective is "to foster and encourage the design, sale, installation, and use of better lighting for maximum seeing comfort in the home, at work and at play; to stimulate greater interest and activity toward continuing progress in electrical illumination."

FPC Reports 529 Mw Net Capacity Gain

PLANT ADDITIONS DURING DECEMBER

State	Utility	Plant	Fuel	Capacity
Calif.	Pacific Gas & Electric Co.	Humbolt Bay	S	51,200
Calif.	Southern California Edison Co.	Portal	H	10,000
Ind.	Northern Indiana Public Service Co.	D. Mitchell	S	138,100
Iowa	Winterset Municipal Utilities	Winterset	IC	1,500
Md.	Hagerstown Municipal Electric Light Dept.	Hagerstown	IC	1,000
Minn.	Mazeppa Municipal Light Plant	Mazeppa	IC	560
Neb.	Sidney Public Utilities	Sidney	IC	3,125
Ohio	Hiram Municipal Light Dept.	Hiram	IC	200
S. D.	Black Hills Power & Light Co.	Kirk	S	16,500
Tex.	City Public Service Board, San Antonio	W. B. Tuttle	S	100,000
Tex.	Texas Electric Service Co.	Eagle Mountain	S	187,500
Utah	St George Utility Commission	St. George	IC	2,865
	RETIREMENTS			
Ga.	Georgia Power Co.	Arco	S	4,000
Ga.	Georgia Power Co.	Davis Street	S	2,000
Ill.	Interstate Power Co.	Galena	S	9,700
Mass.	Worcester County Electric Co.	No. 3	H	256
Mich.	Alpena Power Co.	Thunder Bay	S	3,000
Mich.	Burt Township Light & Water Dept.	G. Marais	IC	178
Mo.	Empire District Electric Co.	Caplinger Mills	H	425
Neb.	Consumers Public Power District	Hartington	IC	416
Neb.	Consumers Public Power District	Harvard	IC	96
Neb.	Consumers Public Power District	Wausa	IC	175
N. H.	Public Service Co of New Hampshire	Sunapee	H	400
Ohio	Hiram Municipal Light Dept.	Hiram	IC	92
Ohio	Ohio Edison Co.	Plain City	IC	1,551
Pa.	Pennsylvania Power & Light Co.	Illuminating	S	5,700
Pa.	Pennsylvania Power & Light Co.	Suburban	S	14,000
Utah	Utah Power & Light Co.	Battle Creek	H	2,400
Utah	Utah Power & Light Co.	Murdock	H	2,500
Utah	Utah Power & Light Co.	South Willow	H	400
Utah	Utah Power & Light Co.	Stairs	H	500
Va.	Virginia Electric & Power Co.	Blands Ford	H	450

U. S.	Hydro	Steam	IC	Total
Added	10,000	493,300	9,250	512,550
Retired	7,331	38,400	2,508	48,239
Adjustments Plus	240	65,675	0	65,915
Adjustments Minus	0	250	631	881
Net Change	2,909	520,325	6,111	529,345

H—Hydro, S—Steam, IC—Internal Combustion

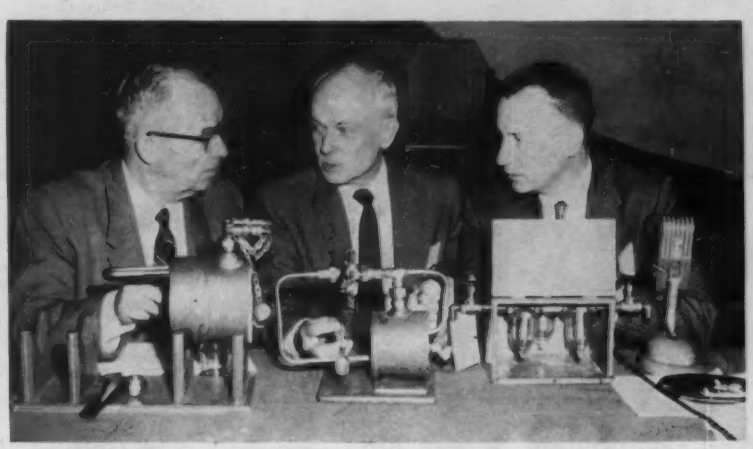
United States Capacity as of January 1, 1957—Hydro, 25,566,984 kw; Steam, 92,463,490 kw; IC, 2,404,775 kw; Total, 120,435,249 kw.

EEI Group Hears Remedies for Voltage Flicker

Cincinnati T&D panels discuss cable performance, network vault bus design

Larger transformers and secondary conductors and shorter secondaries reduce voltage flicker and increase permissible motor starting currents, the Edison Electric Institute's Transmission and Distribution Committee was told at its Feb. 7-8 meeting in Cincinnati.

Panel participants agreed that hp ratings on air conditioning equipment are no longer sufficient, and that nameplates should carry starting and running currents. It was suggested also that utilities standardize their requirements so that manufacturers could produce air conditioning equipment meeting common specifications. The panel disagreed on whether new equipment coming up to speed in 6 to 10 cycles would reduce flicker.



EQUIPMENT for finding gas-filled cable leaks is viewed by D. C. Hawley, Kansas City P&L, W. H. Lohmann, Public Service E&G, T. C. Duncan, Consolidated Edison

Cites Cable Failures

H. R. Davis, Philadelphia Electric Co, could cite no apparent cause for more failures per 100 miles of cable in operation in 1955 than in 1954. But Dr. R. J. Wiseman of Okonite suggested these possible causes: Cyclic movement due to heavy loads, along with lack of manhole space to accommodate such movement; increasing age of cables; and utility company practices based on a desire to cut costs.

Five methods of locating leaks in low-pressure, gas-filled cable systems were described by Walter H. Lohmann, Public Service Electric & Gas Co. But none, he added, is entirely satisfactory on all leaks.

Discussing insulated aluminum bus for 265/460-v network vaults, C. E. Burfield, Consolidated Edison Co, said that such aluminum could be fabricated in a variety of efficient shapes. Insulation for such buses comes in molded forms of impregnated cotton which snap on.

Manufacturers redesigned some industrial plant equipment and some computers when informed of what voltage and frequency changes and short service interruptions they could expect in the equipment's operation, reported H. W. Grate, Cincinnati Gas & Electric Co.

A. A. Hall reported that Baltimore Gas & Electric Co has installed 87,000 circ ft of insulated open-wire primary, the insulated conductors being supported by a two-piece plastic clamp suspended from a copper-clad messenger. This design, he said, gives a satisfactory primary in tree areas at less cost than pre-assembled aerial cable.

Steps important in processing Southern yellow pine poles, said P. J. Berger, Cincinnati G&E Co, are:

1. Fungicide treatment immediately following movement of felled trees to the machine trimmer.

2. Accelerated air seasoning in cross-ventilated, roof-protected storage piles.

3. Electrical resistance tests to determine moisture distribution and to guide seasoning.

4. Individual final inspection and electrical resistance measurements on the framed pole just before treatment.

The mutual assistance task force reported a test on the procedure for tracking storms and distributing helpful information. The "test run" report, originated by Virginia Electric & Power Co, was passed along established channels. It was received by 28 companies, some as far west as Michigan.

Niagara Mohawk Power Corp has replaced its long-established series-circuit with multiple-circuit street lighting, said A. T. Green, describing a downtown modernization program including 700 pendant-type lights. Constant-current transformers in stations and vaults and the change to summer peak in network load to make network capacity available were engineering and economic factors.

Connecticut Light & Power Co, said D. R. Forger, is convinced of the economic soundness of its 28,000 low-voltage, individually controlled street lights. Multiple replaced series lights in 1949.

Standards for low-voltage network transformers were approved by 82% of the companies represented at the meeting of the Standards Committee, Elmer Nuezel, Cincinnati Gas & Electric Co, reported. He said 12% refrained from voting, largely because these companies have no such transformers; only 6% dissented.

Cleveland Electric Illuminating Co's accident frequency rate was reduced to 1.40 in 1956, said F. M. Cox, noting that the overhead lines department rate was cut from 48.04 in 1948 to 2.32 in 1956. The reduction, he said, can be attributed to concerted action, management's active interest in accident prevention, and the practice of consulting with field forces in making decisions concerning their safety.

Employees Want More on . . .	and Said Best-Read Items Are:
1. New developments in the electric industry	1. Employee benefits
2. Job opportunities	2. Business stories
3. Safety	3. Promotions and transfers
4. Industrial development	4. Personals
5. Employee benefits	5. Service anniversaries
6. Company's part in industry	6. Employee activities
7. Information on competition	7. Opinions in the Spotlight (Inquiring photographer feature)
8. Little-known operations	8. Hobby stories

With Contributors' Survey Aid . . . in Getting These Reader Reactions . . .

Editor Gains Guide for House Organ

Without some tabs on reader likes and dislikes, the company magazine editor is like the near-sighted man at eye test time—he knows where to look but, without glasses, the chart remains a blur.

Editor Jack Palmer at Appalachian Electric Power Co has fallen heir to a survey technique that sharpens his point of view on reader preferences. And he gains it for about $300. Here's how it worked last year:

- Correspondents in 23 locations were mailed questionnaires with instructions for getting half of them answered by personal interviews, the other half to be filled in at employee homes.
- They interviewed co-workers for answers on company time (20 minutes each was the average). Workers who took the questionnaire home got a five-minute explanation.
- When forms were returned, Assistant Editor C. R. Lovegrove handled most of the compilation.
- A write-up of results went to management and contributors. Later, a story on the findings appeared in the house organ.

"It lacks much in the way of professional impact surveys," Palmer admits. "But we believe it has provided a very valuable guide in giving us employee readership trends."

After returns were in on the first survey in 1953, for example, a series on unusual industries and their applications of electricity was dropped. Employees, the questionnaire revealed, weren't too interested in the half-page features on serving mink farms, grinding wheel firms, and manufacturers of glass, fire trucks, and marbles.

Last year's survey brought these changes:

A new "Business Ticker Tape" column has capsule comments on regional industrial development.

EW Fillers Fit No. 1 Choice

Another column, "New Developments in the Electric Industry," is Palmer's answer to reader interest in recent utility progress and plans. He uses brief fillers provided free by Electrical World to employee magazine editors. These highlights are based on recent EW articles. "The survey showed that such items were the number one choice by employees of types of business news they would like to have added or wanted more of in the paper," he said.

A new series on employee benefits, which had been getting the best readership at survey time, started early this year.

"Another change" Palmer stated, "is the increased emphasis, both from a standpoint of position and coverage, on company business items. An increased effort is being made to report on a greater variety of company activities. These range from the unusual (use of TV in power plants) to commonplace or the often overlooked obvious (a street lighting feature)."

Key to the survey success is the contributor. The reporters succeeded in obtaining a typical cross section of employees as to age, sex, and job title. They polled 224 or about a 5% sampling of 4,500 workers.

Palmer includes contributor and editorial time in estimating his $300 expense.

The next questionnaire is slated for 1958. "We feel a survey should be made every two years to establish trends that furnish guides for a more effective editing job," said the editor.

His publication, "The Illuminator," is a 12-page slick paper monthly. It is mailed to employees of Appalachian, Kentucky Power Co, and Kingsport Utilities, Inc, all subsidiaries of American Gas & Electric Co.

"The form and direction of the first survey was established by G. S. Dunn, public relations director, and W. A. McClung, former editor and now advertising supervisor," Palmer said.

Shield Wire Cuts Lightning Outages

DISTRIBUTION
Design

Consumers Power Co's 46-kv shielded pole lines make full use of impulse strength of wood to decimate flashovers

BRENT OTTINGER, Overhead and Underground Lines Division, General Engineering Department, Consumers Power Co, Jackson, Mich.

Shielded wood-pole lines, designed to take full advantage of the impulse strength of wood, are reducing lightning outages by 10 to 1 on 46-kv transmission lines of Consumers Power Co. A recent study of the frequency and cause of outages proved the value of this shielding.

Purposes of the shield wire are: (1) to intercept direct lightning strokes, (2) provide a low resistance path to ground, and (3) allow the charge to drain off before voltage can build up and flash over the line insulation.

In the 1920 era Consumers Power had several miles of wood-pole transmission line in service with a ground wire installed on the top crossarm opposite the top phase conductor. Poor footing resistance and relatively low impulse insulation level caused many flashovers, power arc follow, and damage to the line. Therefore Consumers removed the inadequate ground wires.

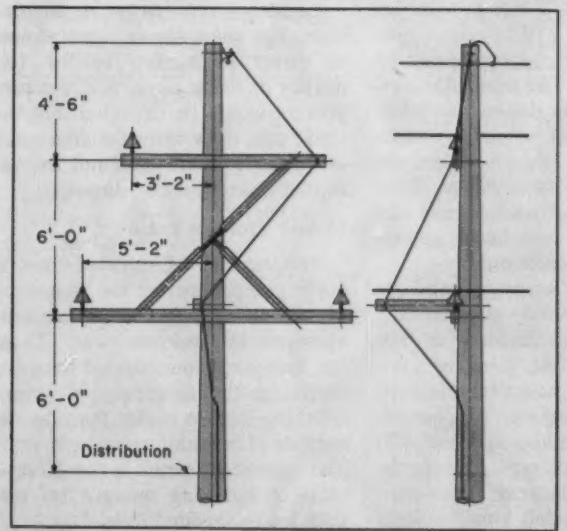
In the 1930 era more work was done to establish the value of wood as impulse insulation. As a result, an attempt was made to design a line of rather high impulse insulation level throughout by installing wood crossarm braces and wood insulators in series with guy wires. This design reduced damage from the currents following power arcs, and many miles of these 46-kv lines are still in service.

Also about this time much work throughout the industry made progress in obtaining economical ground footing resistances. Consumers Power added shield wires and installed low resistance grounds, in the order of 10 ohms, on most towers in the 138-kv system.

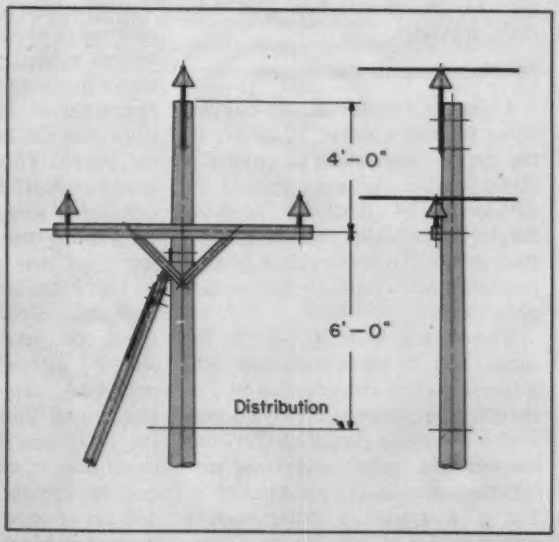
The design of a high-impulse shielded wood-pole 46-kv line was prompted by the need for improved quality of service and by favorable results of the 138-kv shielding program. The first entire 46-kv line to be completely shielded saw seven years without any service interruption. This 6-mi line was built in 1941 near Kalamazoo from Morrow Plant to Phillips St substation.

The shielded design (Fig 1) consists of 8 and 11-ft wood crossarms spaced 6 ft apart. The 8-ft crossarm is offset 6 in. to increase the top and bottom horizontal conductor offset to 2 ft. The shield wire is installed in suspension at the pole top, 4½ ft above the top crossarm. A wood kicker-arm, which parallels the line at the lower crossarm, supports the ground wire down lead and maintains a balance of 7 ft of wood to 3½ ft of air in all insulation paths to ground. The design includes wood crossarm braces and wood insulators in series with all non-grounded guys.

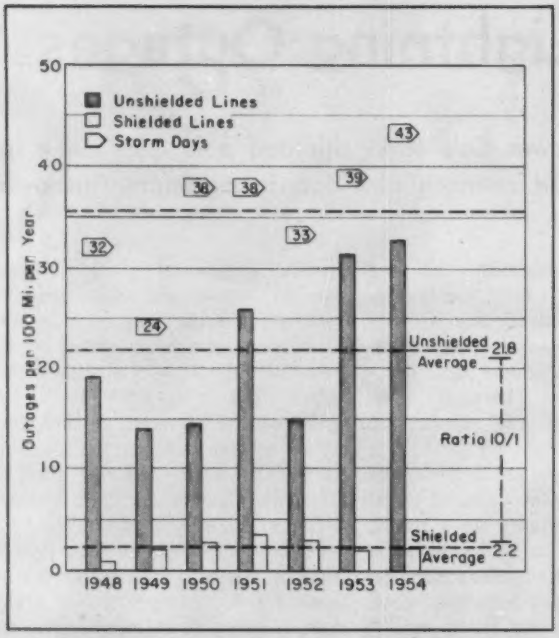
Adapted from a paper presented by the author before Transmission and Distribution Committee, Edison Electric Institute.



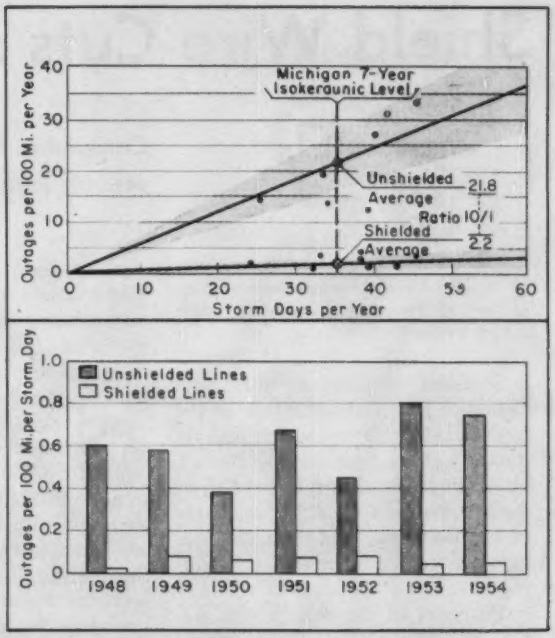
1 SHIELDED DESIGN intercepts direct lightning, provides low resistance path to ground, allows charge to drain off before voltage can build up and flash over line insulation



2 UNSHIELDED DESIGN is of kingpin-type construction generally. It offers little protection against direct lightning but its triangular shape gives best possible conductor offset



3 LIGHTNING OUTAGES over seven years have been reduced 10 to 1 by shielded construction. Performance of shielded lines is fairly independent of the frequency of storms, averaging 2.2 outages per 100 mi per year


Michigan 7-Year Isokeraunic Level
Outages per 100 Mi. per Year
Unshielded Average 21.8
Ratio 10/1
Shielded Average 2.2
Storm Days per Year
Unshielded Lines
Shielded Lines
Outages per 100 Mi. per Storm Day
1948 1949 1950 1951 1952 1953 1954

4 OUTAGES PER YEAR (top) are about in direct proportion to number of storm days for both type constructions.

5 OUTAGES PER STORM DAY reflect annual variations of storm intensity, as indicated by height of vertical bars

The five basic structure types used are: (1) tangent single-arm structure for line deflections of 0-5 deg, (2) double-arm structure for line deflections of 5-14 deg, (3) vertical pull-off structure for line deflections of 15-70 deg, (4) vertical deadend structure, and (5) arm structure with suspension insulators for communication and railroad crossings.

10-Ohm Ground Resistance

Using a conservative impulse value for wet wood of 30-kv per ft, the impulse insulation to ground is about 410-kv positive critical or 420-kv at 4 microsec positive. Single or multiple vertical ground rods are driven to obtain a ground resistance of 10 ohms or less at each pole.

The ruling span is 440 ft for rural, 350 ft for urban, and 300 ft for skip-span construction in city streets. On skip-span construction a short pole is installed between transmission poles and only distribution circuits are attached to it. The ground wire is strung with a mid-span sag of 2 ft less than conductor sag at the ruling span.

Of the company's 3,000 mi of 46-kv lines, 53% are shielded. In the comparative study of shielded and unshielded lines, the latter were generally of kingpin-type construction (Fig 2). This design uses an 8-ft crossarm, 4 ft down from the pole top, supported by wood braces. The structure has a wet impulse insulation of about 310-kv—little protection against flashovers caused by direct lightning. The triangular configuration of this design, however, does give the best possible conductor offset. This feature makes the line practically trouble-free from conductor contact under wind and ice loading and even under galloping conductor conditions.

To obtain an accurate basis for comparison, the study covered only lines completely shielded or unshielded throughout. Also, to compare lines that generally remained unchanged throughout the period, the study was limited to about 400 mi of lines of each type. During the first two years, however, less than 400 mi of completely shielded lines were in service.

The number of line outages per 100 mi per year are compared over seven years in Fig 3. The chart also shows the number of storm days per year as recorded by U. S. Weather Stations at Grand Rapids, Lansing, and Detroit. The over-all average of storm days per year for seven years was 36.

Lightning outages on unshielded lines, the chart shows, vary almost in direct proportion to the frequency of storm days. A direct proportion would be expected, but the chart can show only the frequency of lightning storms and not the variation in intensity or duration.

10-to-1 Outage Ratio

Performance of shielded lines is fairly independent of the frequency of storms, averaging about two outages per 100 mi per year. Thus, the outage rate on shielded lines depends on the frequency of severe lightning strokes rather than on the number of lightning storms per year. The significant point is the 10-to-1 ratio of lightning outages for unshielded to shielded lines.

The ratio of lightning outages to

storm days per year (Fig 4) emphasizes the 10-to-1 outage ratio. But because of the vagaries of lightning absolute values vary widely from predictions, as indicated by the wide shaded area covering points from which the average curves were obtained.

Lightning outages for 100 mi of line per storm day (Fig 5) also show a 10-to-1 ratio—0.6 for nonshielded versus 0.06 average outage for shielded. Significantly, this chart indicates a variation of lightning storm intensity from year to year. That is, if lightning intensity did not vary annually, the vertical bars showing number of outages would be the same height.

Line failures from all causes were reduced 6 to 1 and from causes other than lightning were cut 31% for shielded lines. Better construction and equipment were partially responsible for this improvement.

There have been several outages from conductor galloping, an occasional problem for Consumers Power. The shielded structure design is free from conductor contacts during most ice and wind conditions. However, it is hardly practical to design a 46-kv structure entirely free of contacts during severe galloping conditions.

Slight revisions in the shielded-type construction were made recently to improve line performance under severe ice and wind conditions. These revisions included increasing the ground-wire-to-conductor spacing and reducing the length of spans adjacent to structures with vertical configurations.

A conductor swing diagram for the shielded-type structure (Fig 6) illustrates a condition that occurs sometimes—the conductor on the top crossarm unloads its ice and swings up above the ice-loaded shield wire. Because lightning is not likely to be present under these conditions the spacing is adequate for 60-cps phase-to-ground voltage, as long as all wires swing in the same direction. Two ft of horizontal offset between the top and bottom conductors provides adequate conductor clearance.

Economic Problem Involved

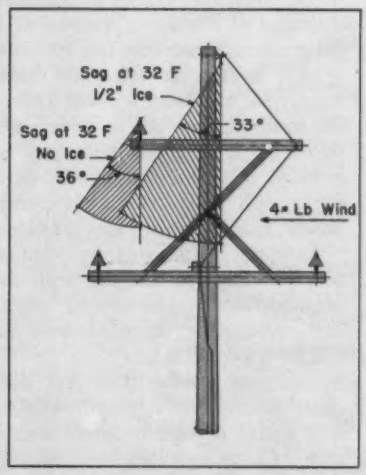
The application of Lissajous ellipses—a method of computing approximate limiting orbits for galloping conductors — to the shielded construction is shown in Fig 7. This method points up the economic problem involved in attempting to design a single-pole structure with conductor separation sufficient to prevent conductor contact under severe galloping.

The most difficult problem in providing adequate spacing occurs when the conductors are in vertical configuration. The pole-top-pin unshielded-type construction and H-frame type construction, as used for higher voltages, are practically free from conductor contact under galloping conditions because the triangular configuration affords the best conductor offset.

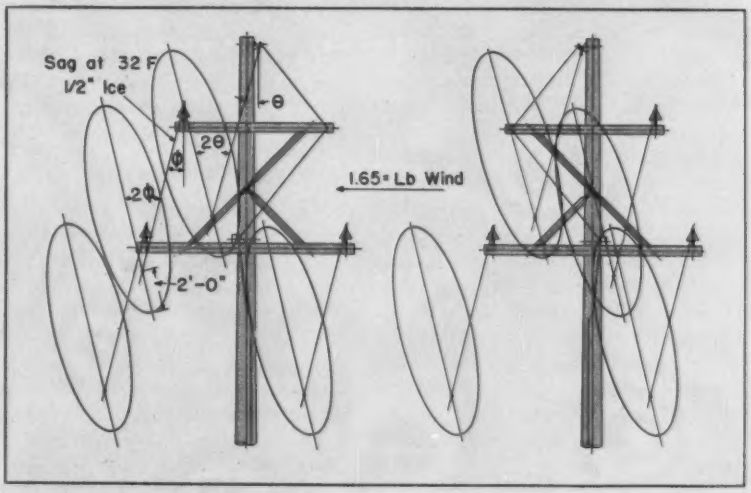
The improved service provided by the shielded design does cost a little more. In this case the direct cost of unshielded lines is 21% less than cost of shielded lines. However, several benefits are achieved by adding shield wire. In many cases, because of the reliability of shielded lines, loads have been served with radial lines that otherwise would require back-up service. In other cases the construction of back-up lines has been delayed several years.

Another benefit derives from the joint construction of shielded lines with one or more distribution circuits. In all joint 46-kv shielded transmission and distribution lines the shield wire is used for the distribution neutral. This makes it necessary to install only one distribution conductor for single-phase-grounded, two for open-wye, or three for closed-wye systems. In effect, the distribution neutral has been moved to the pole top where it is effective as a shield wire.

6 SWING DIAGRAM shows what can occur when conductor on top crossarm unloads its ice and swings up above ice-loaded shield wire



7 LISSAJOUS ELLIPSES are used to compute approximate limiting orbits of galloping conductors. This method points up the economic problem involved in attempting to design a single-pole structure with conductor separation that is sufficient to prevent conductor contact under severe galloping conditions



Twin Cities Utility Builds

SUBSTATIONS
Design

Employs architects to assist design functional buildings that please the eye and yet have that lived-in appearance

E. C. WARD, Electrical Engineer, Stations, and **E. I. LaSERE**, Chief Electrical Designer, Northern States Power Co, Minneapolis, Minn.

In the residential areas of Minneapolis-St. Paul (the Twin Cities) substations and residences can't be told apart. That they can't is a tribute to the Northern States Power Co.

In recent years growing residential loads have forced the company to erect substations in residential areas which it had always avoided. The company was fully aware that the neighbors (and company customers) would frown on conventional substations. So it determined to erect only substations that would overcome this objection. Substations that can't be distinguished from residences meet this requirement.

Sites for substations are determined after a study of load centers and availability of property. Once the site has been selected, a firm of architects is hired to assist in the design of the building and the preparation of related drawings. The resulting structures are functional types of American architecture combining a gabled roof over the indoor portion with an open court simulating an attached garage.

Neighbors Consulted

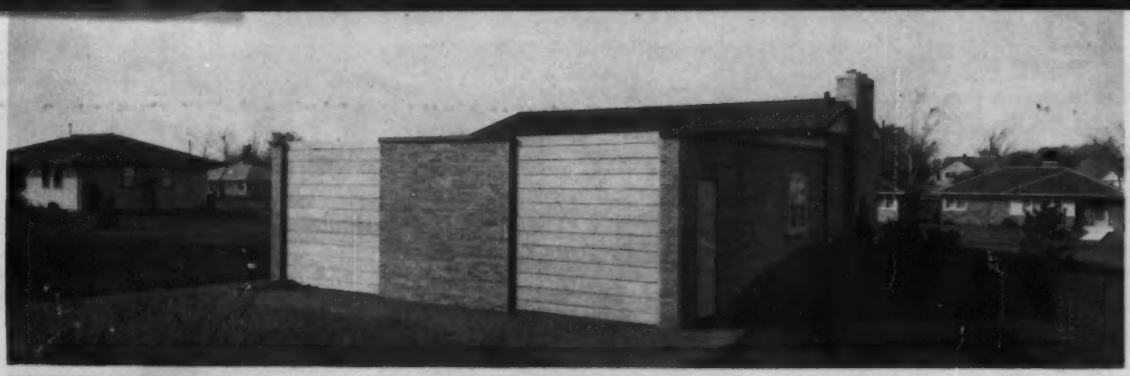
On rare occasions neighbors request that the structure follow a designated style. An example of this is the structure shown in the lower photo on the opposite page. Although the company acceded to this request, it does not consider this a standard design. In most localities it would be unacceptable.

Landscaping is as important as the style of architecture. A well-kept lawn is necessary if the good will of the neighborhood is to be retained. An outgrowth of weeds around a substation would bar erection of similar structures in other neighborhoods.

Each property is sodded as soon as construction permits to eliminate dust and to improve appearance. A programmed underground sprinkler system assures an adequate water supply for the lawn without requiring more manpower. In newer subdivisions it is often necessary to provide this water supply by driving a well and installing a pump. Sewer facilities also are provided.

Sodding is followed by foundation plantings in keeping with the neighborhood. Driveways, steps, and walks are installed with an eye to appearance.

Driveway paving is always adequate to support a mobile substation if use of one becomes necessary. Company cars are usually parked at the rear of the substation area rather than on the street in front.



Substations to Look Like Homes

Windows are lighted during evening hours. A time clock controls this lighting. Such lighting plus venetian blinds provides a "lived in" touch that the neighbors like.

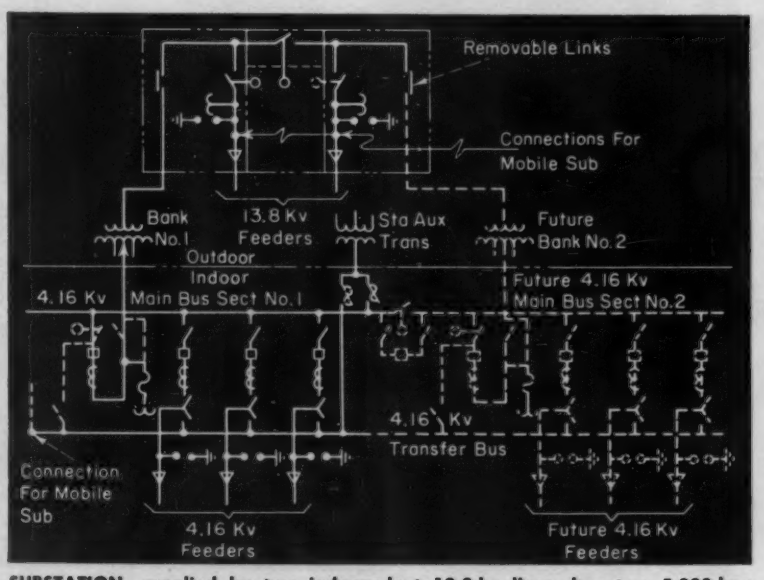
Functionally the substation most often erected consists of two 5,000-kva transformers with three 300-amp feeders on each bank. Two independent 13.8-kv subtransmission supplies are provided. Switching is done by an outdoor-type, metal-enclosed assembly of motorized load-break switches. Normally, one transformer bank is connected to each line. In the event of a line failure, automatic switching transfers the bank affected to the alternate line.

Provide Bus Regulation

Transformers are equipped with load-tap-changer equipment to provide bus regulation. The low-voltage bus-tie switch, operated normally open, provides two independent levels of bus voltage.

Operating flexibility is obtained by remote control for the 13.8-kv switches and the 4-kv bank and bus-tie switches. Isolation of a faulted transformer bank under dead-line conditions is provided automatically. Service restoration to the de-energized feeders is accomplished by remotely closing the bus-tie switch from the dispatching office.

Separate rooms for the bus-tie switch and each 4-kv bus section provide segregation of the two groups of feeder oil circuit breakers. The latter are installed below the bus with a transfer bus above the main one segregated by a tran-



SUBSTATION, supplied by two independent 13.8-kv lines, has two 5,000-kva transformers and three 300-amp feeders on each bank, all masked from view

site barrier. A separate room is provided for the control switchboards and auxiliary equipment. Electric unit heaters are furnished in this room, the only heated area.

Selection of building materials was given thorough consideration. Company requirements, in some instances, were more rigid than those of some local codes. Fireproof construction to a degree was desirable. Poured concrete footings with concrete block walls and brick veneer were used. The court side of the rear building wall is sealed with smooth stucco finish. The concrete blocks are left exposed for the interior of the court walls or cold wall portions.

The roof, a prefabricated sandwich section, consists of two layers of corrugated sheet metal separated by one of insulation. The underside or ceiling is pre-coated with an aluminum finish while the outside is pre-coated with a maroon noncorrosive finish. Roofing is installed by the supplier.

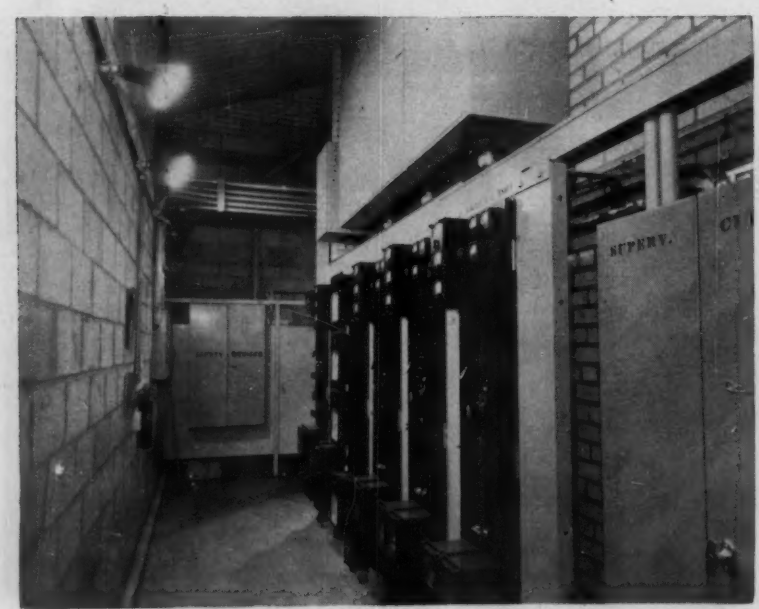
Windows are false and are mounted on the outside of the walls. Building ventilation is provided through the chimney and louvers concealed within the court.

The simulated garage doors, are 6-in. pre-cast concrete beams mounted one above the other in slots provided by 8-in. H columns. They are removable for installation or removal of the large equipment. The court area is surfaced with crushed rock, and the indoor area has a finished concrete floor.

Building floors and court areas are at street level generally, so that the building appears to be above street grade with a slope to the public sidewalk. Where the site must remain flat and level with the street, the entire structure may be lowered by excavating and locating the floor approximately 4 ft below street grade. A sump then provides drainage for the court.

Initial construction allows for the ultimate two-bank installation, thus avoiding undesirable major construction later. The metal-enclosed switch unit and transformers are in the court area. The LTC transformers permit a desirable smaller court area than did bus regulators previously.

TRANSFORMERS and metal-enclosed 13.8-kv switch unit are installed in the court area. Court walls are formed of concrete blocks, except on the building side



SWITCHBOARD, consisting of standard panels, is mounted on the wall between 4-kv equipment and the operating room. Panels are hinged for accessibility

Conduits Minimized

While noise reduction might have been more effective with high court walls, lower walls are important to the architectural appearance. There have been no objections to the noise levels encountered.

The switchboard, consisting of standard panels mounted along the wall between the 4-kv equipment and the switchboard or operating room, has hinged panels for accessibility. Conduits are kept to a minimum by using wire cable troughs. Potheads and lightning arresters in this room are enclosed in sheet metal housings above the switchboard. In all cases it has been practical to run the underground feeders directly to manholes in the street.

Capacitor Fusing Has 5 Functions

DISTRIBUTION
Design

Must isolate, clear, signalize faulted units, allow manual switching, and enable unfaulted units to give rated kvar

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With power capacitors gaining increased recognition for the benefits they provide and finding an ever widening use by electric utilities and industrials, the need for understanding the art of fuse protection becomes more important.

Fusing practices on capacitor banks at distribution voltages (2,400 to 13,800 v) can be separated logically into two classes:

1. "Group fusing" for banks normally mounted on poles and connected to the primary feeder. In this case only one fuse is used per phase, each of which protects two or more capacitor units connected to that phase.

2. "Individual fusing" for large banks normally located at the distribution substation. Here, each capacitor unit is protected by its own individual fuse and back-up protection normally is provided in the form of a circuit breaker or higher rated fuse to protect against bus faults ahead of the individual fuses. (On factory built assemblies the proper fuse is furnished normally by the manufacturer)

Basic reasons for capacitor fusing are:

1. Isolating a faulted bank, portion of a bank, or individual unit without interrupting service on the circuit, thereby reducing consumer-minutes outage on the whole system.

2. Clearing a faulted capacitor from the circuit before gas generated by internal arcing bursts the capacitor case with the possibility of damaging adjacent capacitor units or other equipment and endangering operating personnel.

3. Indicating the location of the fault for easier correction.

4. Providing with the fuse cutout a convenient means for manually switching the capacitor bank, or a section thereof, on and off the line in accordance with system kvar requirements.

5. Isolating the faulted unit of an individually fused capacitor bank to enable remaining unfaulted units to continue delivering their rated kvar.

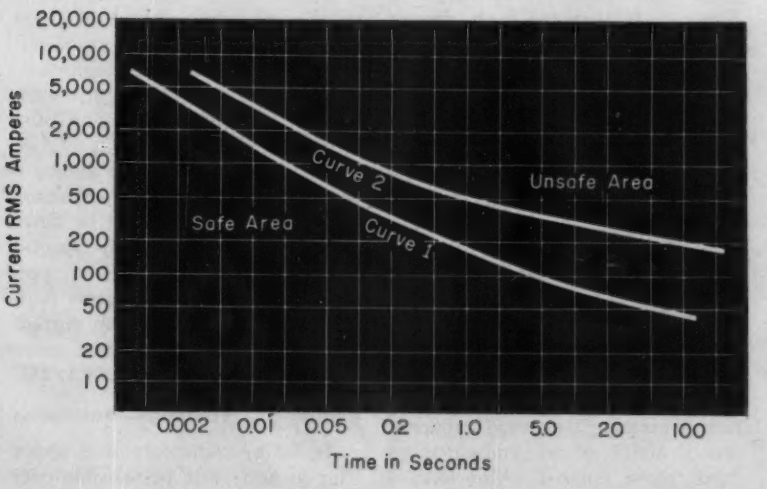


FIG 1—STANDARD CAPACITOR case rupture curve for 15, 25, and 50 kvar units indicates the time required for a unit to burst after an internal short occurs. Area below Curve 1 is safe (no damage beyond slight swelling of case). Area between Curves 1 and 2 is safe in general but an occasional crack in seam or bushing may occur. Above Curve 2 is unsafe as rupture is likely to develop with sufficient bursting violence to damage the adjacent units

Case Rupture Is Troublesome

The most important criterion in fusing capacitors is preventing case rupture from damaging adjacent equipment. When a capacitor dielectric fails from plate-to-plate, the resulting arc creates internal pressure from heat and gas generated in the liquid dielectric. The pressure depends on the amount of fault current and the time it is allowed to flow. This force can swell the sides of the capacitor case, open a seam or bushing seal, or rupture the case to endanger adjacent equipment.

Protection against case rupture involves clearing the failed unit or the whole bank quickly enough to prevent disruptive pressures, or limiting current with current-limiting fuses. An accompanying illustration (Fig 1) provides generally accepted standard capacitor case-rupture (time-current) curves for most 15 and 25-kvar units. This curve was originally introduced in AIEE 49-254 by N. R. Clark and S. B. Farnham. In the absence of industry standards for fusing 50-kvar units, General Electric Co applies the same limits in fusing these units.

Select Fuse to Protect Case

If fuse selection is properly coordinated with these curves, little danger from case rupture will be encountered. It is important that the total clearing, not minimum melting, characteristics of the fuse be used for this coordination. Table I shows the maximum fuse ratings to prevent bursting the case based on characteristics of GE fuses. The maximum acceptable fuse of a given type varies with the amount of available fault current to the failed ca-

Table I—Maximum Fuse Ratings to Prevent Capacitor Case Bursting*

Type of Fuse Link or Fuse	Max. Fuse Link or Fuse Rating, (amp)	Use Current—Limiting Fuse Above This Max. Fault, (amp)
"N" Fast	75	4,000
	85	1,500
	95	1,000
"K" Fast	50	4,000
	65	1,300
	80	800
"T" Slow	25	4,000
	30	2,000
	40	1,000
	50	600
	65	400
Oil Fuse (9F18 Series)	60	4,000
	75	1,000
	100	800
Current Limiting (Type EJ or EJO)	150 at 5 kv**	.....
	100 at 15 kv**	.....

* Applicable to 15, 25, and 50 kva units.
** Should not be applied at service voltages less than 70% of voltage rating of fuse.

pacitor unit. Where fault current exceeds 4,000 amp, current-limiting fuses should be used.

Various makes and types of fuses today show a wide difference in (a) the relation of rating to current at which they melt in 300 sec and (b) the ratio of their 0.1 to 300-sec melting currents. Thus in choosing fuse links or fuses for capacitor applications, it is necessary to compare their time-current characteristics in relation to the performance required to protect capacitors. Major points of comparison are given on the opposite page in Table II.

Pole Banks Group Fused

Group fusing is often used on pole-mounted capacitor banks on distribution circuits where the maximum bank is normally 600 kvar and below. This protective method provides for clearing the bank from the line for any type of bus fault in the bank as well as preventing case rupture of individual units for internal failure.

Grounded-wye or delta-connected capacitor banks pose little difficulty in the selection of the proper fuse link because fault current available to melt a fuse link in the phase containing the faulted unit is limited only by system impedance. Following the considerations in Table II, a suitable fusing schedule can be prepared. Such a schedule is shown in Table III. Some of the fuse links listed should be used only where available line-to-ground (for grounded-wye banks) or line-to-line (for delta banks) short-circuit current is limited to values which will not cause case bursting, as listed in Table I. If available fault current exceeds these values or 4,000 amp, current-limiting fuses should be used according to Table II.

Floating-wye connection is sometimes preferred, although not so extensively as the grounded neutral connection on pole-mounted distribution capacitor banks. Where this connection is used, some peculiarities should be considered.

Floating Y Limits Current

Item 1 of Table II shows, in columns 2 and 5, that the maximum fault current available to blow the fuse protecting the failed capacitor unit is 405% of nominal capacitor bank phase current. Also Item 4 indicates that the minimum current available to blow this fuse may be as low as 285% of nominal capacitor bank phase current. These values are based principally on the current feeding the individual leg of a 3-phase floating-neutral equipment which has a line-to-neutral failure in a capacitor unit.

Fig 2 shows the connection of capacitors and fuses (a) and indication of voltage vectors (b) for normal operation. Here a short circuit in any capacitor units on phase A raises the neutral to phase A with vectors appearing as in (c). Current vectors (d) appear because the impedance in phase A has dropped to zero and impedances in B and C remain normal. The resultant current available to blow the fuse in phase A is equal to three times the phase current prior to the fault. Considering that normal phase current can vary somewhat with changing voltage levels and tolerances in the capacitor units, values between a minimum of 285% and a maximum of 405% are realistic.

Range Complicates Fusing

This narrow range of available fault current complicates choice of fuse ratings for group fusing of floating wye capacitor banks. But the limitations on fault currents feeding into a failed capacitor unit permit much larger fuses to be used and still coordinate with the case bursting curves. Consequently slightly larger capacitor banks can be group fused, at certain voltages, with floating-wye connection than is possible with grounded-wye or delta.

Choice of a fuse cutout for a specific capacitor installation is governed by the relation of its switching ability to normal capacitor current as well as by voltage, current and interrupting ratings, and other circuit requirements and cutout design characteristics. The ability of fuse cutouts to switch capacitors on and off the line must be determined by actual tests with capacitor banks. Expulsion cutouts equipped with load-break mechanisms make them suitable for capacitor currents up to the rating of the fuse cutout at voltages from 2,400 to 15,000.

Evaluate Overvoltage, Harmonics

In fusing capacitors, it is important to anticipate permissible overcurrents due to overvoltages and harmonic conditions. These may raise capacitor current well above the nominal rated value for 48 hrs or more. A fuse, to accommodate this condition, should have con-

Table II—Selection of Overcurrent Protection for Capacitors

Considerations Dictating Choice of Fuse Links, Cutouts or Power Fuse	Group Fusing of			Individual Fusing of Units in	
	Single-Wye 3-Phase Banks with Floating Neutral	Single Delta or Grounded-Wye 3-Phase or Single-Phase Banks	Additional Comments on Banks with Units Fused Individually	Single-Wye 3-Phase Banks with Floating Neutral	Single-Delta or Grounded-Wye 3-Phase or Single-Phase Banks
1. To prevent case bursting when unit fails	Choose fuse rating with total clearing time-current curve on or to the left of Curves 1 or 2 of Fig. 1 up to max fault current to failed unit. Use current limiting fuse when max fault current to failed unit exceeds current at which the fuse total clearing time-current curve crosses Curve 2 of Fig. 1 or 4000 rms amp. This limits slow ("N" or "T") more than fast ("N" or "K") fuses.				
			Protection from case bursting provided by individual unit fuses so group fuse rating can be higher and not limited by 4,000 rms amp rule	Unit fuses are rated so low this is not a problem below 4,000 rms amp. Refer banks over 6,000 kvar at 5 kv or 10,000 kvar at 15 kv to manufacturer for study.	
Maximum fault current to failed unit	Generally limited to 405% of nominal capacitor bank current	System L-L or L-N fault current at point of installation.		Generally limited to 405% of nominal capacitor bank current.	System L-L or L-N fault current at point of installation.
2. To assure fuse will interrupt max. fault current	Choose fuse cutout or fuse rated to interrupt at least max fault current to failed unit. See 1 for fault current to failed unit			See 1 for fault current to failed unit	
	Fuse might have to interrupt system L-L or L-N fault current at point of installation.			Limitation of fault current applies in all cases.	
3. To assure carrying normal capacitor current continuously and melting fuse only when capacitor unit fails	Choose a fuse rating which will carry continuously at least the % of nominal capacitor current given below: a) For "N" or oil cutout fuse links which melt at about 150% of rating in 300 sec or "continuous overcurrent ratings" of "K" or "T" fuse links given by manufacturer. b) For "N", "K", or "T" fuse links or "E" power fuses which melt at about 200% of rating in 300 sec for which no "continuous overcurrent rating" is given by manufacturer. Use rating of the link which defines its continuous current carrying ability. Check for case bursting as these links have higher time-current characteristics. Using lower rated fuse links to prevent case bursting may cause unnecessary fuse blowing or damage the cutout.				
	150% of nominal bank current	165% of nominal bank current	Higher rating to coordinate with unit fuses	165% of nominal individual unit current	
4. To assure bank or unit will be isolated from system at min fault current to failed unit	Choose fuse link or fuse rating which clears (Total clearing time-current curve) in 300 sec at:				
	285% (95% of 3 times) nominal capacitor bank phase current.	Minimum L-L or L-N system fault current at point of installation.	Unit fuses provide this protection so group fuse can be larger.	Unit fuses rated so low this is not a problem. 235% of nominal capacitor bank phase current.	Minimum L-L or L-N system fault current at point of installation.
5. To assure cutout and power fuse will operate on system voltage	Choose cutout or power fuse with voltage rating equal to or greater than: (a) Phase-to-phase voltage of system for 3-phase banks. (b) Values below for single-phase banks:				
	No single-phase applications	Phase to neutral voltage		No single phase applications	Phase to neutral voltage
6. To assure cutout will switch normal capacitor current	Load break cutouts, which switch currents up to their ratings, require no additional checking.			Fuses on individual units generally not used for switching.	
	Max. permissible fuse link rating chosen in 1, 3, & 4 may limit kvar of bank that can be switched.		Cutout switching ability only limit to kvar of bank.		

Table III—Group Fusing Grounded-Wye & Delta Connected Distribution Capacitor Banks

(With Distribution Fuse Cutouts Where Units Are Not Individually Fused†)

Bank Rating 3-Phase kvar	2400v N or oil	2400v K or T††	4160v N or oil	4160v K or T††	4800v N or oil	4800v K or T††	7200v N or oil	7200v K or T††	12,470v N	12,470v K or T††	13,200v N	13,200v K or T††	13,800v N	13,800v K or T††
75	30	20	20	12	15	10	15	10	15	10	15	10	15	10
150	75	50	40	25	40	25	20	12	15	10	15	10	15	10
225			75/60#	50	50	40	30	20	20	12	20	12	20	12
300			75	50	75	50	40	25	25	15	25	15	25	15
375					75	50	50	40	30	20	30	20	30	20
450			100/—#*	—	95/—#*	80/—Δ	75	50	40	25	40	25	40	25
525							75	50	40	25	40	25	40	25
600							85/—#*	65/—Δ	50	40	50	40	45	30
675									75	50	50	40	50	40
750									75	50	75	50	75	50
825									75	50	75	50	75	50
900									75	50	75	50	75	50

Fuse link ratings are within the range 1.65 to 2.0 ± times nominal capacitor current.

To prevent case bursting (See Table I and II), fault current to the failed unit should not exceed 4,000 rms amp for all fuses listed in table nor 600 amp for 50 T, 1,000 amp for 40 T and 75 oil, and 2,000 amp for 30 T.

† Recommended fuse link for single phase installations may be found by multiplying single-phase kvar by 3 to obtain equivalent 3-phase kvar rating and then selecting fuse link recommended under the corresponding 3-phase line-to-line voltage rating.

†† Fusing at these values is possible only with "K" or "T" fuse links having continuous overcurrent ratings which equal the "N" rated fuse links having similar 300 second melting currents.

Second value is oil fuse rating when different from "N" rating given first.

ΔSecond value for "T" fuses when different from "K" fuse rating given first.

* Based on preliminary test data on 50kvar units. Not applicable to 15 or 25 kvar units.

tinuous-current-carrying ability large enough to avoid overheating.

Fuse links of Type (a) in Table II Item 3, chosen under the rule of fusing at a minimum of 150 or 165% of nominal capacitor current, have the required continuous current-carrying ability and time-current characteristics best adapted to prevent case bursting. Fuse links of Type (b), also chosen under the rule of fusing at a minimum of 150 or 165% of the nominal capacitor current, have higher time-current characteristics which make case bursting more of a problem.

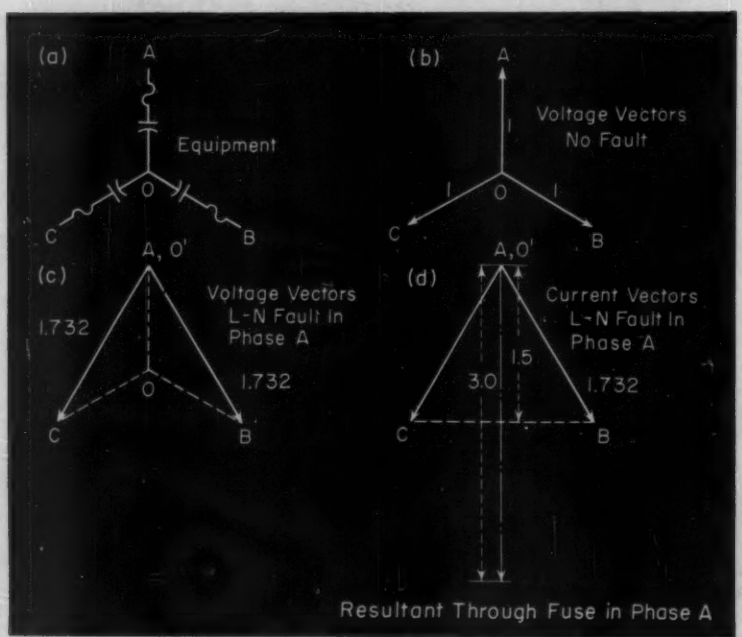


FIG 2—VECTORIAL RELATIONSHIP shows the phase currents for a 3-phase floating neutral capacitor bank under a line-to-neutral short in one phase

Closer Fusing Detrimental

Fusing at a lower minimum of 110 or 124% of nominal capacitor current to obtain time-current characteristics similar to Item 3, Type (a) links, may subject links to currents caused by harmonics and overvoltages which are in excess of their continuous current-carrying ability. These overloads might cause dried-out, brittle fuse-holders or damage other parts of the cutout even though the overloads would not prove detrimental to the capacitor. Deterioration of cutout parts would be more apt to occur with fuse links having high temperature fusible elements than with those having low temperature elements which can be designed to carry more current continuously.

Table I—Load Data for Shopping Center

	Department Stores	Wearing Apparel Stores	Home Furnishing Stores	Food Markets Supermarkets	Service Stores
General Lighting (va/ft²)	6 to 9	5 to 7	3 to 5	4 to 6	2 to 5
Show window lighting (va/lin ft of window)	300 to 450	300 to 450	150 to 300	Nil	25 to 75
Outlet load (va/ft²)	0.6 to 1.8	0.5 to 0.8	1.5 to 5	0.25 to 0.75	0.25 to 2.5
Air Conditioning (ton or hp/units of floor space)	1 per 200 sqft*	1 per 250–300 sqft	1 per 350–400 sqft	1 per 350–400 sqft	5 to 20 total
Refrigeration				30 to 50 hp from connected motor loads of 50 to 100 hp	
Parking lot lighting	1 ft-c or 0.1 to 0.3 va/ft²				

* For every 50 ton of air conditioning there will be about 15 hp of air handling equipment.

Shopping Centers Desirable Loads

W. H. FERGUSON, Electric Utility Engineer, Industry Engineering Department, Westinghouse Electric Corp, East Pittsburgh, Pa.

Shopping center loads usually are desirable in many respects. But they spring up quite suddenly in undeveloped sections where existing distribution is not adequate to meet requirements. The engineer who designs the new power supply must consider many factors, among which are capacity, voltage regulation, reliability, and economy.

A shopping center is often the best lighted, best air conditioned commercial property in town. It provides a lighted, off-street parking area for customers. Most tenants are alert, progressive merchants who make good use of air conditioning, lighting, and other electrical aids in displaying their wares. The shopping center sets the standard in modern merchandising methods which other stores of the community will follow.

The shopping center is a good power customer. It has a good load factor. The stores are in full electrical operation 10 to 12 hr a day, 6 days a week, throughout the year. There are no better commercial loads.

Probably the easiest way to evaluate shopping center loads is in va per sq ft. The average load in va/ft² varies considerably from one center to another, depending on types of stores, degree of illumination, air conditioning, etc. A practical range for consideration on new construction would be between 8 and 16 va/ft². The majority of the new shopping centers have average load densities in the order of 10 to 14 va/ft².

Lighting load may represent as much as half of the total demand of the shopping center. Large chains that operate branch stores in shopping centers have increased the illumination level in each store over the preceding one to secure the sales improvement attributable to better lighting.

Air conditioning and food refrigeration make up most of the remaining load. Air conditioning has become prevalent in practically all shopping centers. The air conditioning load varies considerably due to geographic location, and estimates of the load must take this into account.

The convenience and special outlet load varies over a wide range from store to store, depending upon type of commercial operation. The outlet load in a shoe store may be 0.25 va/ft² but may run as high as 15 va/ft² in a restaurant having all-electric kitchens.

Table I lists fairly average conditions. Any special loads that are to be considered must be added.

Table II presents data for areas within the shopping centers. Load values include lighting, air conditioning, refrigeration, and convenience outlets. Special outlet loads were not included. An average power factor of 80% has been assumed.

Load densities in the tables can be used to estimate peak demands for a given store. But diversity makes the total something less than the sum of individual demands. This factor varies between shopping centers, but values between 1.1 and 1.5 may be anticipated.

Examples Show Load Requirements

The following examples are considered to be fairly typical of shopping centers today. Their load densities may be exceeded in new centers, but the general components would be similar.

A large shopping center near principal cities has about 12 major buildings with a total floor area of 1,125,000 sq ft and parking space for over 5,000 cars.

TABLE II—Shopping Center Area Load

Dry Goods, Clothing	va/ft²	Food Stores	va/ft²	Services	va/ft²
Auto Supplies	4.5– 9.5	Bakery	4.5– 9.5	Bank	5.5–12.0
Camera Store	6.0–11.0	Beverages	4.5– 9.5	Barber Shop	9.5–20.0
Children's Clothing	10.0–16.0	Candy Store	6.0–12.0	Beauty Shop	9.5–22.0
Department Store	13.5–26.0	Dairy Store	8.0–15.5	Bowling Alley	4.0– 8.0
Drug Store	9.5–19.0	Meat Market	9.5–16.5	Dry Cleaners	4.5– 9.0
Electric Appliances	7.5–14.0	Produce Market	7.0–13.5	Laundry	4.0– 9.5
Furniture Store	7.5–17.5	Supermarket	9.0–16.0	Loan Agency	6.5–13.0
Gift Shop	7.0–13.5			Motion Picture	10.0–20.0
Hardware Store	4.5–10.5			Photo Studio	7.0–14.0
Jewelry Store	9.5–18.0			Post Office	4.5–10.5
Men's Clothing	10.0–16.0			Restaurant	10.5–20.5
Phonograph Records	4.5– 9.5			Shoe Repair	4.5–10.5
Shoe Store	8.5–14.5				
Sporting Goods	7.0–13.0				
Variety Store	12.0–22.5				
Women's Clothing	10.0–16.0				

The electrical load of such a project was estimated as 7,400 kva maximum demand. But when one of the first buildings was occupied its two 300-kva transformers were found to be inadequate and were replaced with 500-kva units. The loads will probably exceed the estimated 8.3 va/ft². This load is about half lighting and half power, all but two of the major buildings being air conditioned.

Distribution is 125/216 v, 3-phase Y. Each building is served by an isolated spot network with single contingency provisions. Transformer sizes were determined on the basis of one transformer being adequate for maximum load where two primary feeders are used and two transformers where there are three primary feeders. Primary supply is three 13.8-kv underground feeders.

A shopping center of medium size now about 5 years old typifies the earlier experience with this type of load. It has four one-story buildings totaling more than 200,000 sq ft. Parking space, provided on one side of the group of buildings and in some courtyard areas, is lighted by incandescant floodlights. Total load was given as 1,333 kw. This works out as 8.5 va/ft² at 0.80 pf. A diversity factor of 1.25 gives an undiversified average demand of 10.4 va/ft². The load is a little more than half power, mostly air conditioning.

This load is served by a 120/208-v, 3-phase, 4-wire, radial-secondary system. Each building has its own vault with three oil-immersed, self-cooled distribution transformers. Primary distribution is a single open-wire 7.6/13.2-kv feeder.

Correct System Dictated by Economics

No one distribution system is best for all shopping centers as variations in shape and size have considerable effect on the choice. The correct system in any particular instance is the one that economically provides the required quality of service. But small shopping centers generally have simple physical shapes and can be served well by simple radial-distribution systems. Larger and more complex centers require more elaborate systems. Loads in the largest shopping centers justify a full network supply system.

Utilization voltages need not be limited to the conventional 120/240-v 3 phase. Use of 265/460-v, 3-phase should be considered in new commercial buildings. Properly installed systems can be as free of hazard at 460 as at 208 v. A few special precautions are required for 460-v circuits, but the National Electrical Code permits up to 300 v to ground on circuits supplying permanently installed electric-discharge lamp fixtures, providing the luminaires are mounted 8 ft from the floor and do not involve manual switching as part of the fixture. Hence a grounded 265/460-v system can be used to supply all fluorescent or electric-discharge lighting as well as motors.

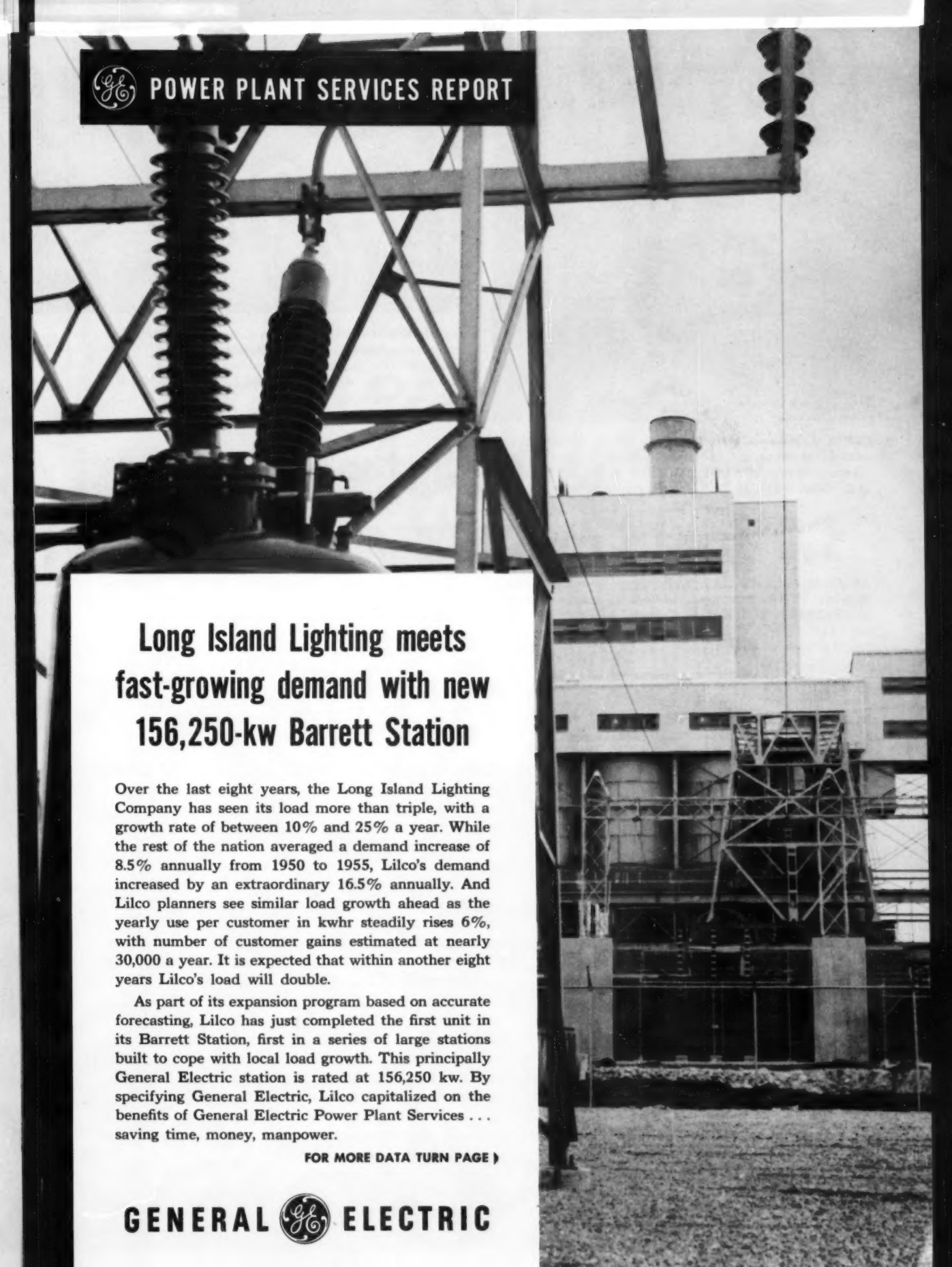
Cost Lower at 265/460 V

High levels of fluorescent lighting and extensive air conditioning in modern shopping centers make 265/460-v service attractive.

Principal advantage of the higher voltage stems from less current and less voltage drop in the circuits. Fewer or smaller circuits can be used to transmit power to panelboards or other final distribution points. Smaller conductors can be used in many branch circuits serving power loads, and some reduction may be possible in other branch circuits. And utilization equipment is generally available and is electrically suitable for the principal loads.

Local or incandescent lighting, small fractional-horsepower motors, and plug-in devices usually are available only for 120-v operation. When 460-v service is provided, stepdown transformers must serve the loads. The proportion of this type of load varies considerably depending on the purpose of the building and, to a lesser degree, on its size.

Total electric system cost is generally lower at 265/460 v when less than half of the load comprises 120 or 208-v devices. The higher voltage is more favorable in multi-floor buildings than in one-story buildings, but utilization equipment accounts for the biggest portion of electric system cost and should be considered in any economic comparison.



POWER PLANT SERVICES REPORT

Long Island Lighting meets fast-growing demand with new 156,250-kw Barrett Station

Over the last eight years, the Long Island Lighting Company has seen its load more than triple, with a growth rate of between 10% and 25% a year. While the rest of the nation averaged a demand increase of 8.5% annually from 1950 to 1955, Lilco's demand increased by an extraordinary 16.5% annually. And Lilco planners see similar load growth ahead as the yearly use per customer in kwhr steadily rises 6%, with number of customer gains estimated at nearly 30,000 a year. It is expected that within another eight years Lilco's load will double.

As part of its expansion program based on accurate forecasting, Lilco has just completed the first unit in its Barrett Station, first in a series of large stations built to cope with local load growth. This principally General Electric station is rated at 156,250 kw. By specifying General Electric, Lilco capitalized on the benefits of General Electric Power Plant Services . . . saving time, money, manpower.

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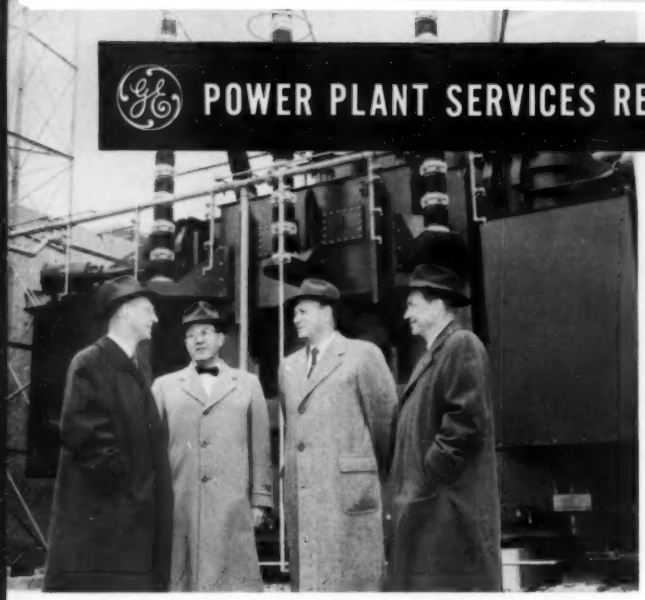
GENERAL ELECTRIC

POWER PLANT SERVICES REPORT

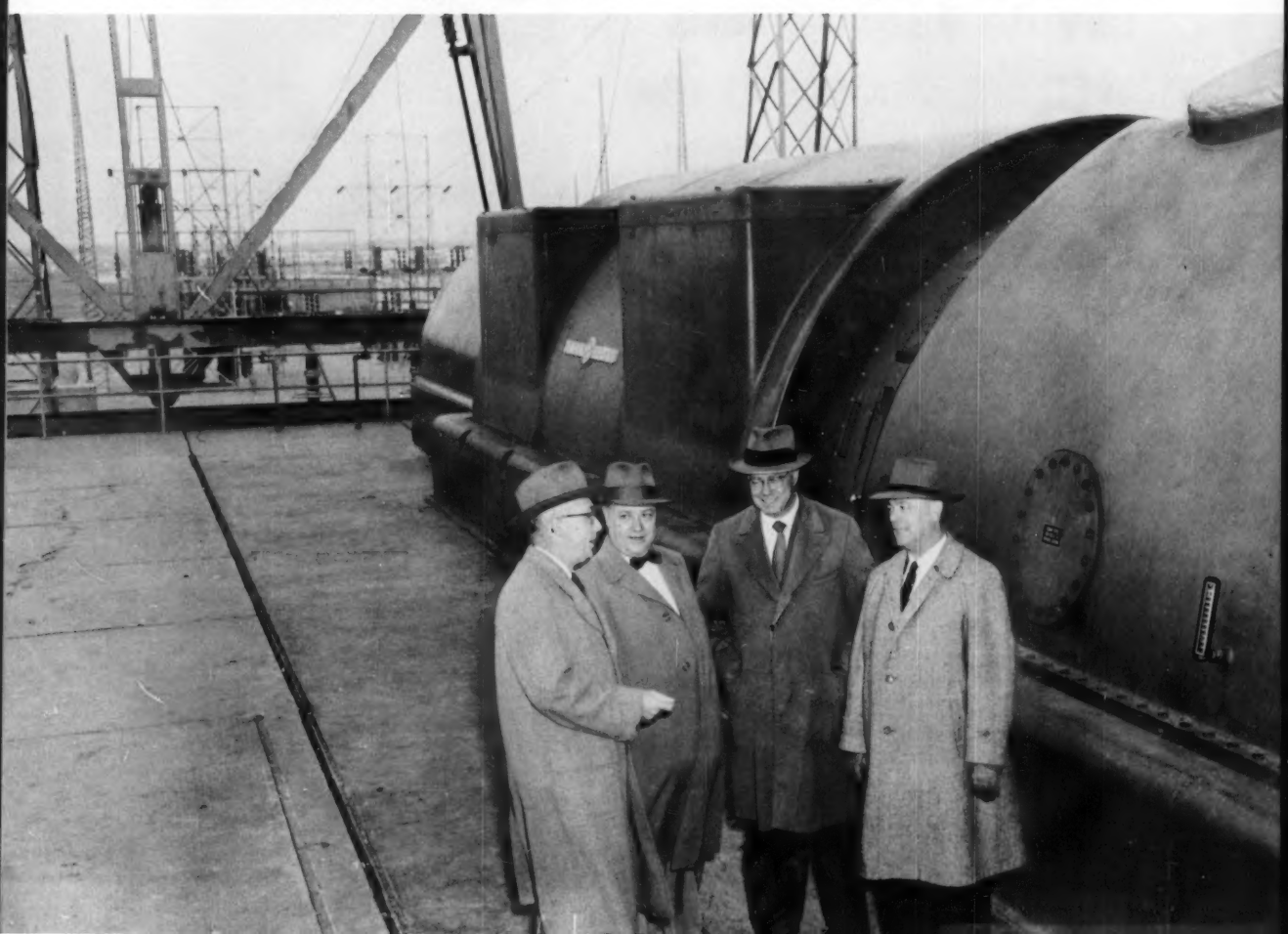


TREND to reduced basic insulation levels in large transformers is shown by 138-kv, 190,000-kva forced oil air-cooled unit insulated for 550 kv-BIL. L to r, E. Bateman, G.E.; Lilco engrs., C. Kiel, Jr., M. Marshall, A. Jorgenson.

SCHEMATIC LAYOUT, both mechanical and electrical gives complete instrumentation, increases efficiency of G-E control board. Lilco's G. Raulston explains operating advantages to M. Lennig, G.E.; E. Deturk and M. Buckley of Lilco.

Northeast's newest

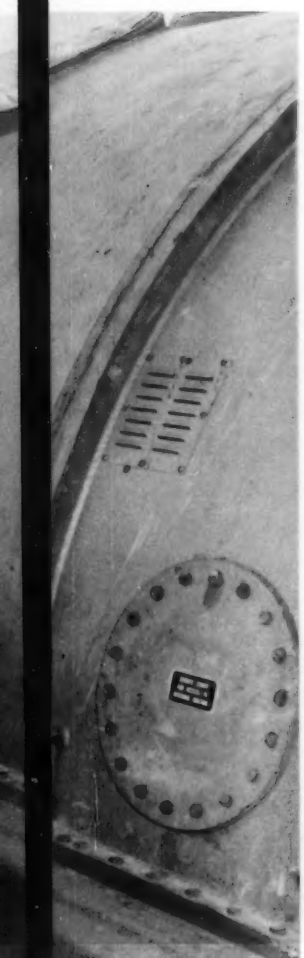
UNUSUAL ARRANGEMENT for Northeast is outdoor General Electric tandem-compound, triple-flow, reheat unit rated at 156,250 kw. Lilco V.P., E. C. Duffy, and Asst. V.P., W. O. Smith, discuss station design with G.E.'s E. R. Cotton and Lilco Asst. V.P., W. Welch, Jr. Turbine, generator and exciter are well protected against cold and weather hazards.



EASILY INSPECTED drawout air circuit breakers are a feature of Long Island Lighting's installation of General Electric 480-v switchgear used to control and protect station auxiliaries. Above, Operator R. G. Schmalfeld inspects breaker.

ENGINEERING TEAMWORK provides minimum cost, optimum efficiency for new station. G-E Sales Engineer Wharton Clay, Jr. discusses new equipment with Lilco Engineers B. Kelly, J. Martone, A Colyer, A. Denike, J. Carll, Jr.

outdoor station expedited through co-ordinated engineering of Lilco, G. E.



The construction of outdoor generating stations in the Northeast has been a recent development. Barrett Station is the newest of three such power plants on Lilco's system. That the Long Island Lighting Company should select such a design for an area prone to considerable temperature changes, often with harsh winters, and the year round action of salt water from the adjacent Atlantic Ocean, is a tribute to imaginative management action and highly competent utility engineering planning.

RELIABILITY ESSENTIAL

The physical characteristics of the Edward F. Barrett Station's site demanded the best in equipment reliability and engineering. Working very closely with Lilco engineers, General Electric application engineers helped to select and integrate the most suitable apparatus for the job. This mode of operation was carried through from planning to start-up, conserving utility engineering manpower and bringing the combined skills and experience of many General Electric specialists into all phases of the program.

MULTIPLE BENEFITS

This is typical of the many ways in which General Electric Power Plant Services can assist on your job. Some of its other aspects are product development engineering, field service engineering, power plant co-ordination and service engineering which also help to:

- **Simplify ordering of equipment**
- **Conserve engineering time**
- **Integrate equipment design**
- **Speed construction**
- **Assist in training operators**

For full information on these Power Plant Services, contact your General Electric Apparatus Sales Office or write for 28-page bulletin GEA-6320 to General Electric Company, Section 302-14, Schenectady 5, N. Y.

FOR MORE DATA TURN PAGE ▸

MORE POWER TO AMERICA

GENERAL ELECTRIC

CO-OPERATIVE PLANNING is typified by this group, (l. to r.) Asst. Mgr. Eng. Dept., A. C. Sugden; Asst. V.P. William Welch, Jr.; and Mechanical Engineer William J. Burns of Lilco, in discussion with General Electric Application Engineer M. Lennig, Lilco Planning Engineer, J. L. Davidson, and Electrical Engineer E. F. Deturk.

General Electric application engineers help your planning team keep costs minimal

Simplified planning from basic concept to station completion is key to savings

When Lilco forecasters determined, in terms of area load growth, the necessity for increasing system capability, a power plant planning team went into operation. General Electric application engineers were an integral part of this team. One of their vital contributions was to provide guidance to help determine what basic concepts and equipments best suited Lilco's requirements. This planning resulted in the most efficient and economical station for Lilco's needs.

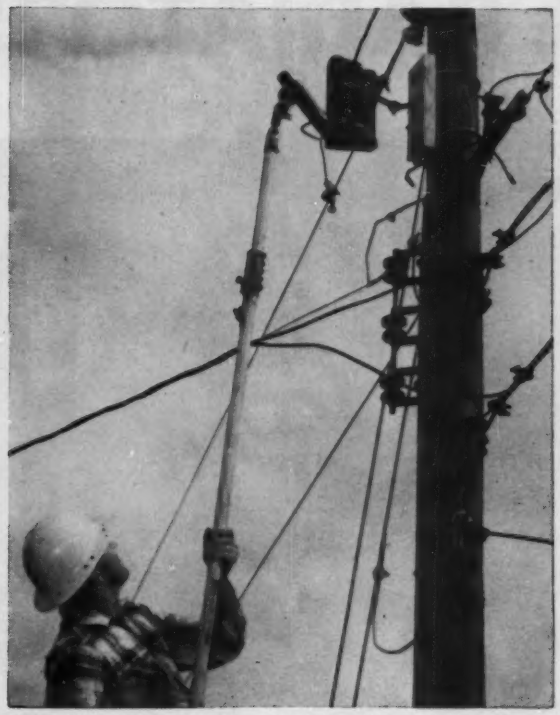
In many cases the General Electric power plant service team works closely with electric utility engineers and their consultants from initial planning through equipment selection, installation, and start-up. The net result of such co-operation is substantial savings to you in time, money and manpower.

As the trends in power station equipment continue to require higher ratings, improved efficiencies, and even greater reliability, the advantage of selecting General Electric apparatus, combined with the time-saving, money-saving benefits of General Electric engineering team-work, offers electric utilities a striking example of why it pays to call in General Electric early when planning a new station.

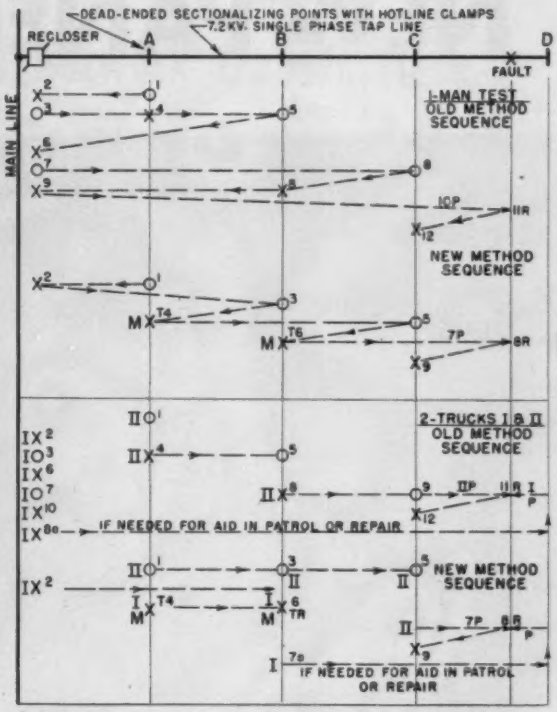
LIVE BETTER ELECTRICALLY

MORE POWER TO AMERICA

GENERAL ELECTRIC



LINEMAN operates fuse cutout with a hot stick. Bracket on the special block holds cutout connected to the line



TEST PROCEDURE, along with testing device, shortens time for locating faults on the line and the overall outage

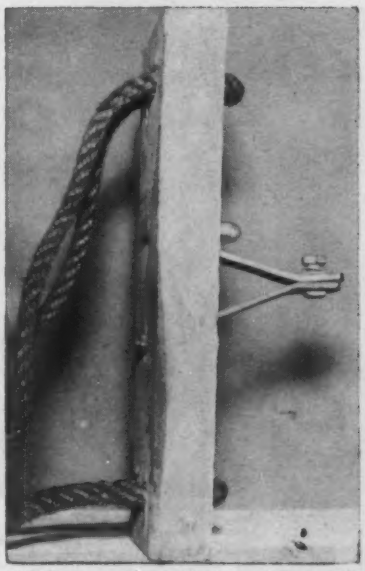
DISTRIBUTION—Maintenance

Testing for Line-Fault Location Facilitated

L. C. VALLEY, Scott County Area Supervisor, Appalachian Electric Power Co, Abingdon, Va.

Faults on 7.2-kv, single-phase lines of the Appalachian Electric Power Co in this district are located and cleared with the least annoyance to customers through use of a procedure developed by the writer. The procedure involves use of the device illustrated, which can be carried on a service truck.

This device is a 2x6x13-in. piece of pine with a ⅜-in. manila rope through corner holes for tying it to a pole 1½ to 2 ft below the hot-phase dead-end insulators at sectionalizing points. The bracket on the block is for a fuse cutout which is connected to the line each side of the sectionalizing point by hot-line clamps handled with hot sticks. The cutout is closed by a hot stick.



BLOCK is a piece of pine with manila rope and bracket for holding cutout

The test cutout, however, should have a rating suitable for the short-circuit currents that may occur. This can be determined from the type of recloser installed on the line tested. Some reclosers are limited to 1,200 amp, so that the test cutout should have the same rating.

Where heavy-duty reclosers are installed, the test cutout should have corresponding capacity. When enough heavy-duty reclosers are installed, test cutouts of the same capacity should be carried on each truck.

The proper size of fuse for use in the test cutout can be determined from the following:

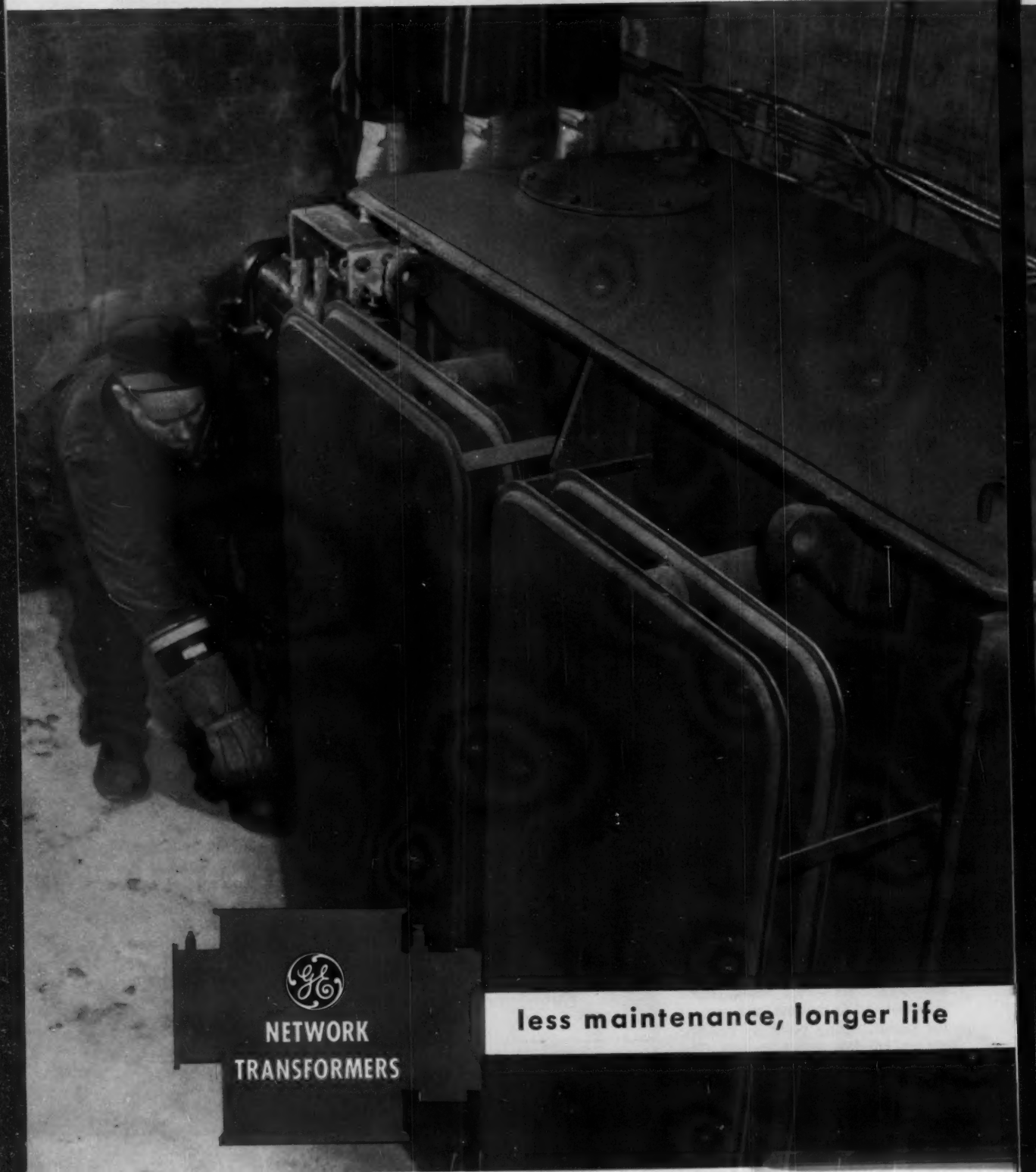
1. Tag on recloser giving by-pass fuse size.

2. Chart or list of fuse sizes for area covered.

3. Base station which has oper-

(Continued on page 80)

NEW PANEL RADIATORS...



less maintenance, longer life

..on General Electric vault-type network transformers mean maintenance savings for Western Massachusetts Electric Company

Western Massachusetts Electric Company recently installed the first units of a new type of General Electric network transformer for vault service. The new transformers feature panel radiators, which G.E. introduced in 1954 for subway service. The new radiators offer maintenance savings for utilities everywhere.

Fewer Entrances Increase Reliability

Now standard on all ratings for vault service, the new radiators greatly increase transformer reliability because there is less chance for leaks. There are only eight entrances into the transformer-tank wall compared with 56 on the 500-kva tubular-radiator design. The radiators minimize danger from corrosion because they discourage the accumulation of dirt, moisture, and all types of corrosive elements. Radiator edges are narrow and sides are smooth, vertical planes.

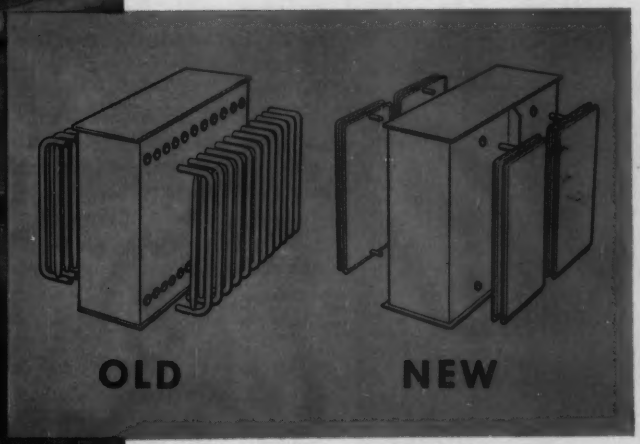
Panels Simplify Cleaning, Repainting

With smooth panels, it's a cinch to clean or repaint the radiators. A few sweeps with a long-handled brush remove the dirt. And repainting is almost as easy since the radiators are flat panels instead of tubes.

HELP FOR YOU

For help in solving your network problems and for complete information on the advantages of G-E network transformers with new panel radiators, contact your local G-E Apparatus Sales Office—or write to General Electric Company, Schenectady 5, N. Y. 435-15

LIVE BETTER ELECTRICALLY



CONVENTIONAL-DESIGN radiators (left) have many tank entrances. New panel radiators require only eight entrances into tank. This greatly reduces chance for leaks, increasing reliability.

NEW PANEL radiators are easy to clean. Workman's flashlight shows space between panels, and between panels and transformer. Vertical, smooth surfaces retard dirt collection.

Progress Is Our Most Important Product

GENERAL ELECTRIC

Test for Line Fault

(*Continued from page* 177)

ating map giving fuse sizes by areas.

The test cutout should be attached temporarily to the pole and connected while open to the line each side of the sectionalizing point with hot-line clamps handled with hot sticks. The line jumper at the sectionalizing point is opened with hot sticks before both the recloser and the test cutout are closed.

The procedure and testing device definitely shorten the time for locating faults on lines and reduce the overall outage of customers when only one service truck is used. The procedure also has merit when the two vehicles used are equipped with radio. Its advantages include:

1. Simple to mount device.

2. Rigid cutout mounting prevents jumpers swinging against pole.

3. Connections are made with hot sticks.

4. Cartridge fuses are used.

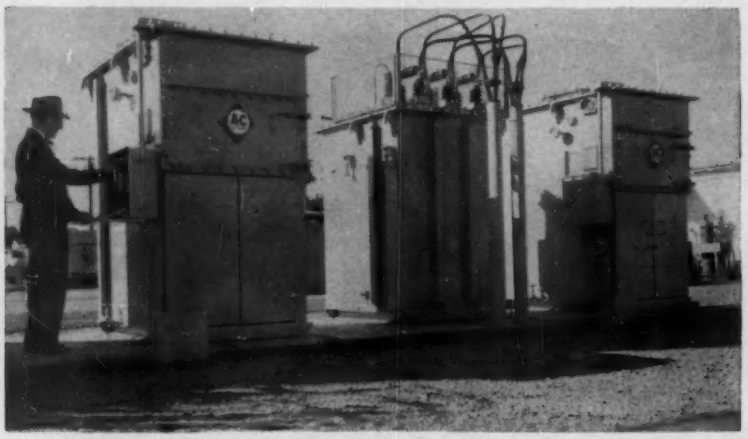
5. Applicable at dead-end sectionalizing points.

6. Prevents interruption to customers on line sections restored to service.

7. Permits more efficient use of manpower and trucks, as personnel do not have to be left at or returned to any point on the line.

SUBSTATIONS—Design

Modification Aids Safety, Appearance



ENCLOSED SWITCHES on the side of a 12-kv, 563-kva regulator allowed Pacific Gas & Electric Co to use space undesirable for a conventional regulator

CABLES TERMINATE below the operating mechanism in the completely-enclosed 4-kv, 225-kva regulators which were installed by Southern California Edison Co

A more pleasing appearance and greater safety can be designed into station-type distribution regulators by completely enclosing all energized equipment. Two recent installations illustrate how the modified design justifies the increased cost.

In the design of the completely-enclosed regulator, cables are led into the unit through the bottom, or into a metal-clad compartment on the side. This eliminates the less sightly and exposed disconnect and by-pass switches and overhead bushings.

Southern California Edison Co is installing the completely enclosed units in substations adjacent to residential areas. The more attractive appearance is illustrated in the upper photo which compares the completely-enclosed unit with conventional regulators.

Edison plans to install more than 100 of these.

Another advantage accrued to Pacific Gas & Electric Co through the use of a completely enclosed regulator. The unit, with no energized equipment exposed, was close to and at a lower elevation than a fence bordering on a public sidewalk. The modified regulator avoids a safety hazard and makes use of space that was undesirable for a conventional regulator.

(*More How To on page* 84)

GENERAL ELECTRIC ML-32 STEP VOLTAGE REGULATORS on the line at the substation of a large midwestern utility.

Midwest Utility Finds That General Electric ML-32 Voltage Regulators Require

"PRACTICALLY NO MAINTENANCE"

By Bob Bry, Manager—Marketing Voltage Regulator Product Section

A large midwest electric utility has been installing a great many of our ML-32 step voltage regulators. We asked them why, and here is what they told us:

One of their Division Superintendents said: "I like the ML-32 from the maintenance point of view. There is practically no maintenance as compared with other types or makes of regulation. I feel we save time and money because it isn't as necessary to continually check the G-E regulators."

He feels that big dollar savings have resulted for his company because "installation of the G-E regulators has cut down on the number of maintenance trips we've had to make to outlying areas and the oil field sections."

Another reason for this utility's preference for ML-32 regulators is the G-E Load Bonus which allows them to increase current capacity while the regulator is energized.

Another one of their Division Superintendents put it this way: "I especially like the ML-32's Load Bonus feature because, in cases where the load builds up and exceeds the regulator rating, we can use Load Bonus to obtain a capacity of 160%. In other words, in cases where the load builds up, we set the taps up on the transformer and set the regulator to boost 5% and buck 10%."

Reduced maintenance costs and increased current capacity can save your company money, too. Learn more about this new G-E regulator by asking your G-E representative or by writing Section 423-22, General Electric Co., Schenectady 5, N. Y.

Progress Is Our Most Important Product

GENERAL ELECTRIC

ONE-PIECE, STEEL tank is small and compact; green finish affords pleasing appearance.

Announcing a brand-new switch for General Electric capacitors

New 15-kv oil switch has fewer moving parts; Nitrile rubber gaskets seal out moisture

Modern system economics have brought about the growing use of switched capacitors on distribution feeders. For this essential application General Electric has developed a totally new and superior oil switch rated 15 kv, 200 amps, and known as the "Type FKC."

Now available only on General Electric capacitor equipments, the new G-E switch incorporates all of these features:

- High-speed action—for maximum freedom from restrike
- Erosion resistant contacts—brazed with silver molybdenum
- Fewer moving parts—less wear, simpler maintenance
- Detachable motor control—just loosen two screws
- Re-usable gaskets—seal out moisture, prevent leakage
- Belleville washers—compensate for cold-flow, suitable for Al/Cu
- Light weight—only 33 lbs. when completely filled
- Manual operation—handle operates independently of motor

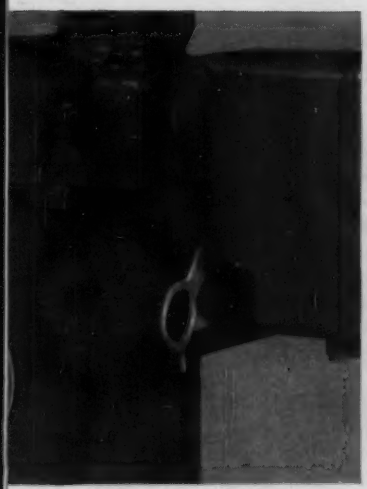
The Type FKC oil switch was designed by General Electric specifically for capacitor switching. It can switch a nominal capacitor current of 150 amps. Its momentary asymmetrical rating is 9000 amps.

The Type FKC switch is built to help protect both your capacitor and switch investments; to provide you with long, dependable service. Its many features combine with the uniform quality of G-E capacitors to make up an all G-E equipment of unsurpassed effectiveness and reliability.

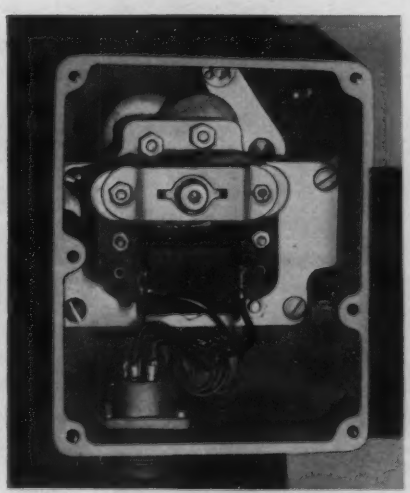
Ask your G-E Apparatus Sales Engineer for full details on autoswitch capacitors, and for bulletin GEA-6554. Or write to General Electric, Section 445-7, Schenectady 5, New York.

Progress Is Our Most Important Product

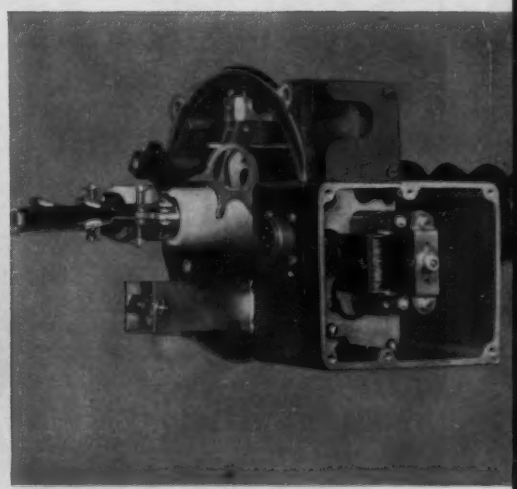
GENERAL ELECTRIC



HAND-LEVER is easy to get at; works independently of motor mechanism.



MOTOR CONTROL MECHANISM draws less than two amperes. Simplified design makes all parts easily accessible.



RE-USABLE NITRILE RUBBER GASKETS form an effective seal but permit one-way venting of internal pressure.

YOUR STREET AND HIGHWAY LIGHTING PROGRAMS NEED LUMATROL®

FULLY AUTOMATIC CONTROL

Three little words tell the **big** story about new LUMATROL Model S:

RELIABILITY...
SIMPLICITY...
ECONOMY...

Hundreds of installations across the nation prove LUMATROL to be the greatest single advance in outdoor lighting since the luminaire. It provides the kind of control that saves budgets, saves manpower, and reduces dusk to dawn accidents.

EXCLUSIVE FEATURES . . . Omni-Directional Light Sensing . . . No orientation . . . Plug-in-out . . . absolute stability with no calibration drift . . . shrugs off extreme cold and heat, rain and snow . . . No Phototube in circuit . . . Weatherproof, crackproof cover . . . Compact . . . Harmonizes with any installation.

Write today for technical bulletin on LUMATROL MODEL S.

micro balancing
INCORPORATED
GARDEN CITY PARK, L. I., NEW YORK
Trade Mark Reg. U.S. Pat. Off.

WINDING DRUM has bars on spokes which engage and turn portable reel

Power-wind Cable To Cut Manpower

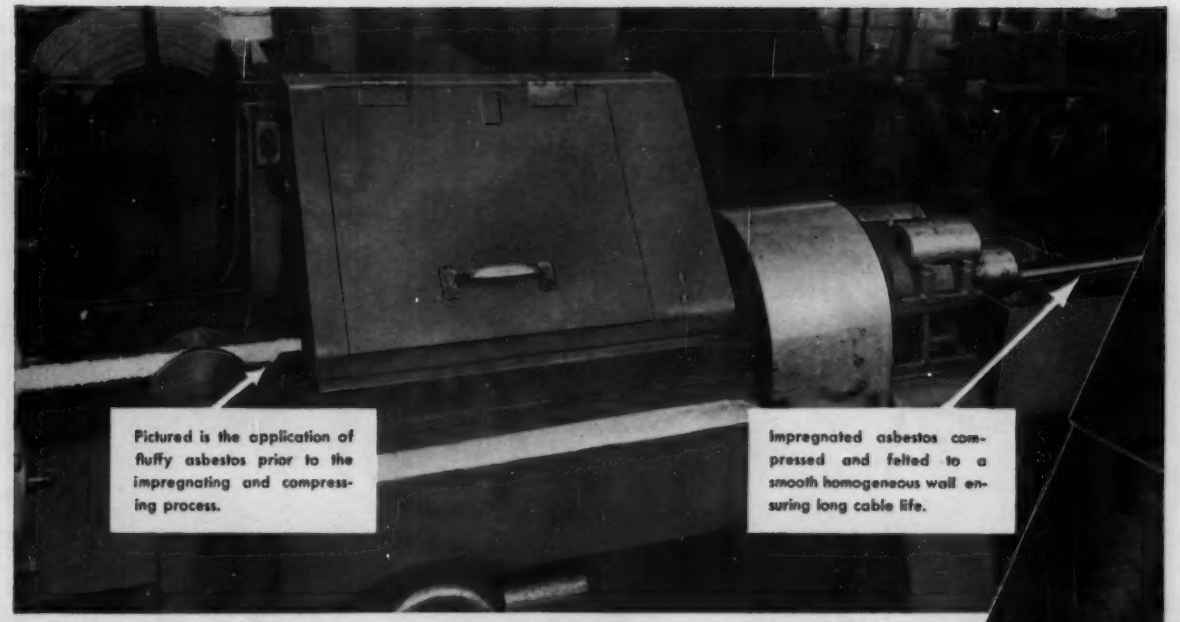
Heavy, lead-covered cable is power-wound onto portable reels with considerably less manual work through the use of a special turning drum and jacking mount at Portland General Electric Co. The combination enables two men and a winch truck to do a job formerly requiring the time and manual effort of six. The idea was developed by Joel Huppunen, PGE derrick truck operator.

Lifts Empty Reel

The drum and mount combination is used by the underground department to transfer lengths of cable from manufacturers' reels to a portable, steel reel for carrying to the jobsite. The turning drum is slipped onto the bar on which the reel turns and then secured to the reel. Two bars on the drum spokes engage and turn the reel through its radial channel member. The bars' bent ends provide a snug fit on the channel. The drum is driven by the truck's winch and cable.

The empty reel with drum attached is lifted by the jacking mount. To hold the mounted reel steady, two steel shafts are placed

(*Continued on page* 86)


Pictured is the application of fluffy asbestos prior to the impregnating and compressing process.
Impregnated asbestos compressed and felted to a smooth homogeneous wall ensuring long cable life.

It's the
ROCKBESTOS
ASBESTOS VARNISHED CAMBRIC
COMBINATION
Beneath the Braid
that Assures Long Cable Life

Seamless Felted Asbestos Walls

+ Impregnation with selected compounds

+ Quality Varnished Cambric Tapes

N.E.C. Type AVA Wire and Cable may look alike on the surface. But a look under the braid will quickly show why the Rockbestos A.V.C. gives longer lasting service.

First, two dense, uniformly impregnated felted asbestos walls seal the varnished cambric tapes. They keep the dielectric strength high . . . give added strength against damage and flexing.

Second, the varnished cambric tapes are made to *our own exacting specifications* which incorporate standards beyond those called for by industry.

Add to this, thirty years of know-how in the application of asbestos and VC Tapes to Rockbestos A.V.C. and you get wires and cables that eliminate costly rewiring jobs and expensive maintenance . . . assure long cable life.

Write for the new booklet "Specification RSS 88" which gives complete construction and test specifications.

STOCKED COAST TO COAST
Standard Rockbestos A.V.C. construction (N.E.C. types AVA, AVB, etc.) are available for immediate shipment. Call or write nearest branch office.

ROCKBESTOS PRODUCTS CORPORATION
NEW HAVEN 4, CONNECTICUT
NEW YORK • CLEVELAND • DETROIT • CHICAGO • PITTSBURGH • ST. LOUIS
LOS ANGELES • NEW ORLEANS • OAKLAND, CALIFORNIA • SEATTLE

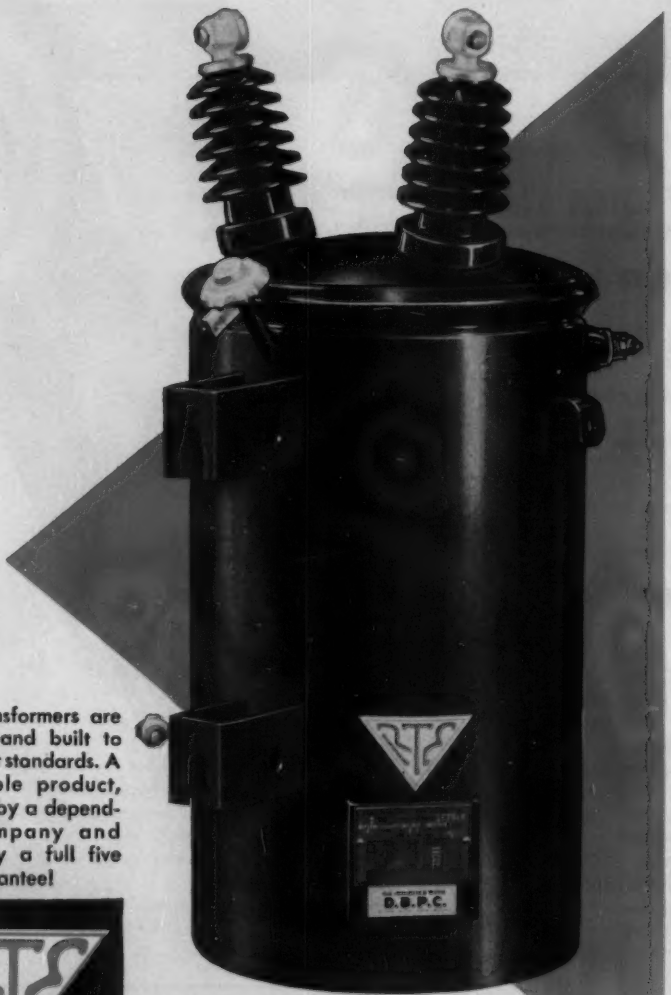
What Makes RT&E Transformers Better?

OUTSTANDING BASIC DESIGN

Easy to Install... Operate... Maintain...

Every RT&E Transformer combines the result of years of industry progress with the experience and creative thinking of RT&E Engineers.

The result is a transformer that is low on losses, regulation and weight — high in impulse strength and overload capacity. A transformer thoroughly tested for top performance.



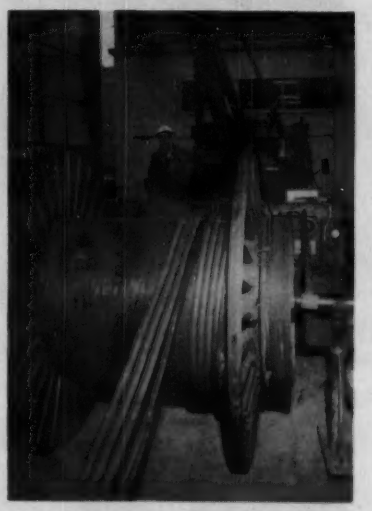
RT&E Transformers are designed and built to the highest standards. A dependable product, produced by a dependable company and backed by a full five year guarantee!

RT&E CORPORATION
WAUKESHA, WISCONSIN

OUTSTANDING BASIC DESIGN — *Another reason why* **RT&E** *is better!*

Power Wind Cable

(*Continued from page* 84)



JACKING MOUNT and steel shafts hold reel turned by the winch and cable

between the reel bar and the truck. Short lengths of pipe, welded to one end of each shaft, slip over the reel bar. The other end of each shaft is secured to the truck bed.

As cable is wound onto the portable reel, one man guides the cable while the operator runs the winch. After the cable is wound, the reel is lifted to carrying position by the truck boom and carried to the job.

For one job, four 82-ft lengths of lead-covered, 600-v cable, weighing 3.5 lb per ft, were power-wound from a full reel onto a portable one in a single operation. Total weight of the cables was 1,148 lb. Without power winding, it would have taken four men to wind the four lengths of cable onto a reel manually and two other men would have been needed to control the slack.

TRANSMISSION—Maintenance

Guy Grips Solve Long-Span Trouble

Special 9-ft pre-formed guy grips were used to repair breaks just outside of a three-bolt clamp or about 4½ ft from a dead-end thimble on an Otter Tail Power Co 2,000-ft span across water. Inspection had revealed fatigue of two strands on

(*Continued on page* 88)

New York City's "14th Street Association" proves modern whiteway lighting pays big dividends

With the use of P & K aluminum standards and LUXaire® Fluorescent Luminaires, the average light level on 14th Street, a major downtown shopping center, has been increased from 0.4 to better than 2 foot candles. The P & K LUXaire® units, specially designed in wedge shape, are mounted at 30-foot height on staggered 70-foot spacings.

The choice of P & K equipment, combining high strength with light weight, permitted the use of existing electrical vaults with a minimum of excavation and foundation work. Installation was quick, easy, and low in cost. Negligible maintenance requirements, a feature of all P & K products, will serve to keep the *real* cost of lighting equipment on 14th Street surprisingly low.

Comments from the 14TH STREET ASSOCIATION, who paid for the new lighting: "New White way has accomplished its purpose . . . business improvement . . enhanced shopping area . . . safer for shoppers and vehicular traffic. . . ."

WRITE FOR A COPY OF THE P & K LUXaire® Catalog . . . and use the P & K planning and advisory services without obligation.

P&K PFAFF & KENDALL

84 FOUNDRY ST., NEWARK 5, N. J.

IT PAYS TO HAVE HUBBELL GOOD CONNECTIONS

and here's another NEW product

SOLD ONLY THROUGH AUTHORIZED ELECTRICAL WHOLESALERS

UNUSUALLY SHALLOW

GROUNDING DEVICES

Designed For Panel Mounting

The No. 5258, 125 volt, parallel slot receptacle (and its companion unit, the tandem slot 250 volt, No. 5658) is a competitive, yet very rugged, single, flush-mounted device designed for grounding exposed metal parts of portable electrical equipment. It is side wired with green grounding terminal binding post.

Each unit, when fitted with mounting flange, makes up a new female motor base, Cat. No. 5256 and No. 5656.

Male motor bases (No. 5288 and No. 5668), fitted with "U" shaped pin for grounding, are designed for use with 3-wire, grounding-type cord, connector bodies.

- Round "Shoulderless" design permits mounting in restricted spaces.
- Unusually shallow depth
- Green hexagonal grounding screw
- Rugged bakelite construction
- For use with metallic or non-metallic wiring systems

Parallel Slot 125 VOLT 15 amp.

Tandem Slot 250 VOLT 15 amp.

HARVEY HUBBELL, INC.

HIGHEST QUALITY WIRING DEVICES • MACHINE SCREWS

DEPT. E-2 BRIDGEPORT 2, CONNECTICUT

WIRING DEVICE WAREHOUSE LOCATIONS ASSURE NATIONWIDE STOCK AVAILABILITY

Bridgeport 2, Connecticut
State and Bostwick Streets

Chicago 7, Illinois
37 South Sangamon Street

Los Angeles 12, California
103 North Santa Fe Avenue

San Francisco, California
1475 Hudson Avenue

Dallas 7, Texas
1111 Dragon Street

Solve Span Trouble

(*Continued from page* 86)

each of two dead-ends after the span had been in service two years.

No signs of fatigue of the conductors or of the pre-formed guy grips were found in a recent inspection, and there was no evidence of slippage between grip and conductor.

Early in the spring of 1951, Otter Tail, with headquarters at Fergus Falls, Minn., installed the 2,000-ft span across Lake Ashtabula just west of Luverne, N. D. This lake had been created when Baldhill Dam was built across the Sheyenne.

The conductor for this crossing was ½-in. extra-high-strength, seven-strand steel. On each side of the lake, 70-ft poles were installed. The conductor was sagged for 50% of ultimate strength at zero F under heavy loading conditions.

Breaking strength of the conductor was 26,900 lb. Dead-ends were made through a large guy thimble and use of heavy 3-bolt clamps.

The guy grips were installed in the spring of 1954, when inspection revealed evidence of trouble and the need for some repair of damaged conductors. A better dead-ending scheme was also called for.

SUBSTATIONS—Design

Models Help Solve Design Problems

When designs for Union Electric Co's proposed Berkley substation indicated that there may be some question of clearances, engineers William Zvanut and Robert Setchfield built models of the substation terminal and the adjacent tower. The models were of balsa wood and to a scale of ⅛ in. to 1 ft. A fine jewelers chain simulated conductors.

When the balsa "steelwork" was completed, the jeweler's chain, representing the 115-ft spans of conductors was strung in place. All field conditions, including slack in the conductors, were duplicated as closely as possible. Clearances on the model were measured, and the measurements checked against clearances on design drawings.

METAL-CLAD SWITCHGEAR

PURIFIED PORCELAIN in horizontal and vertical bus supports, primary disconnect bushings and caps and epoxy in bus joint covers provide excellent insulation, prevent fires in 15 kv I-T-E metal-clad switchgear.

EPOXY AND SPECIAL CERAMICS protect personnel and equipment by preventing fires in the circuit breaker section. Arc chute rear supports and blowout coils are epoxy. Jump gap cooling plates, arc chute liner plates, arc plates and spacers are special ceramics.

Only the finest fire-protective insulating materials

Nonflammable porcelain and ceramics, flame-resistant epoxy, and other flame-retardant insulating materials throughout, are among the extra values you find in I-T-E Metal-Clad Switchgear. Purified porcelain, of which the primary disconnect bushings and caps are made, also supports both vertical and horizontal bus. It is nonflammable, has high dielectric strength, won't track or deteriorate, is inherently contamination free.

Epoxy, which can be molded into complicated shapes, forms arc chute rear supports, blowout coils, bus joint covers, potential and current transformers. It has high mechanical and dielectric strength, is nontracking and extremely flame resistant.

Special ceramics, highly resistant to direct arc exposure, are used in jump gap cooling plates, arc chute liner plates, arc plates and spacers. These have high dielectric strength, low moisture absorption, won't track, are excellent interrupting materials. They do not deteriorate when subjected to direct arc exposure. They absorb thermal shock and deionize gases without excessive heating.

Phenolic and polyester insulating sheets and moldings, specially treated to provide the highest possible degree of flame-retardant characteristics, are also used.

If you are planning new construction or modernization requiring electric power, consider the advantages of I-T-E equipment. Consult your local I-T-E sales office or write I-T-E Circuit Breaker Company, 19th & Hamilton Sts., Philadelphia 30, Pa.

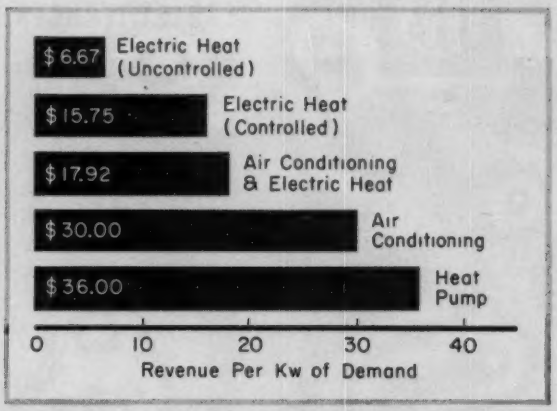
I-T-E CIRCUIT BREAKER COMPANY • Switchgear Division

IN CANADA: EASTERN POWER DEVICES, LTD.

Heat Pumps:

They Provide More $ per Demand Kilowatt

Florida Power Corp, with 40% of the heat pumps in the country, finds promotion and dealer training makes for a profitable load



MORE REVENUE PER KW of demand is provided by heat pumps than any other type of electric heating and cooling

G. C. HALL, Supervisor, Air Conditioning Department, Florida Power Corp, St. Petersburg, Fla.

Heat pumps provide a greater revenue per kw of demand than any other individual or combined type of electric heating or cooling. For this reason, as well as having the customers' interests in mind, Florida Power Corp (including Georgia Power & Light Co) actively promote heat pumps to the point where it now has more on its systems than any other utility in the country.

To date 3,235 units have been installed; this represents about 40% of the total for the country. And more heat pumps are going into service at the rate of 140 a month.

Company Trains Dealers

This record results from our programs of promotion and of training dealers' sales and maintenance people. However, before these programs were started, we had to convince ourselves that the heat pump was basically workable and would be satisfactory for the consumer.

To this end many makes of units were installed in company buildings beginning in 1945. Both water and air were found to be effective heat sources, depending on the application. When using water, the type and availability must be considered; for air, space and noise are problems. Although the COP is higher for water heat sources than for air, the air appears more trouble-free, and may be as economical as water.

Promotion efforts started nine years ago, but were limited until dealers had equipment and trained personnel. Engineering and maintenance courses were conducted by the company.

Dealers, architects and engineers were invited to learn how to make installations using the method of the American Society of Heating and Air Conditioning Engineers. This method was used because it follows that used for other types of combustion heating equipment.

When requested, engineering help can be obtained from six company engineers. They make surveys and prepare plans for small air conditioning and heat pump installations not usually handled by engineering consultants. For larger installations the company recommends the use of consultants. In cases in which additional help is requested by a dealer or consultant, the prospective customer's name is held in confidence. We remain neutral regarding the make of equipment.

Florida Power urges all dealers to have trained servicemen to insure adequate customer service. These men are trained by our specialists right at the dealer's establishment. Informal personal presentations, using "live" heat pumps, demonstrate the operation of equipment, its problems and remedies.

The company has four service specialists who go troubleshooting with the dealer's servicemen. We consider this the best type of training. In emergencies our specialists will service any heat pump to insure that the customer is kept happy.

We promote heat pumps through advertising and personal contact, and stress eight specific benefits to the customer:

1. Cooling—Refrigeration drives away summer heat with cool, comfortable air . . . automatically.

2. Heating—Reverse cycle operation of the same unit provides a plentiful, smooth, even flow of controlled warm air.

3. Dehumidifies — Moisture is "squeezed" out of damp air, filling the room with crisp freshness and preventing mildew and mold . . . automatically.

4. Clean—Dust, lint, pollen, etc., are filtered out, insuring healthful air . . . automatically.

5. Ventilation — During mild weather plenty of fresh air is provided at all times.

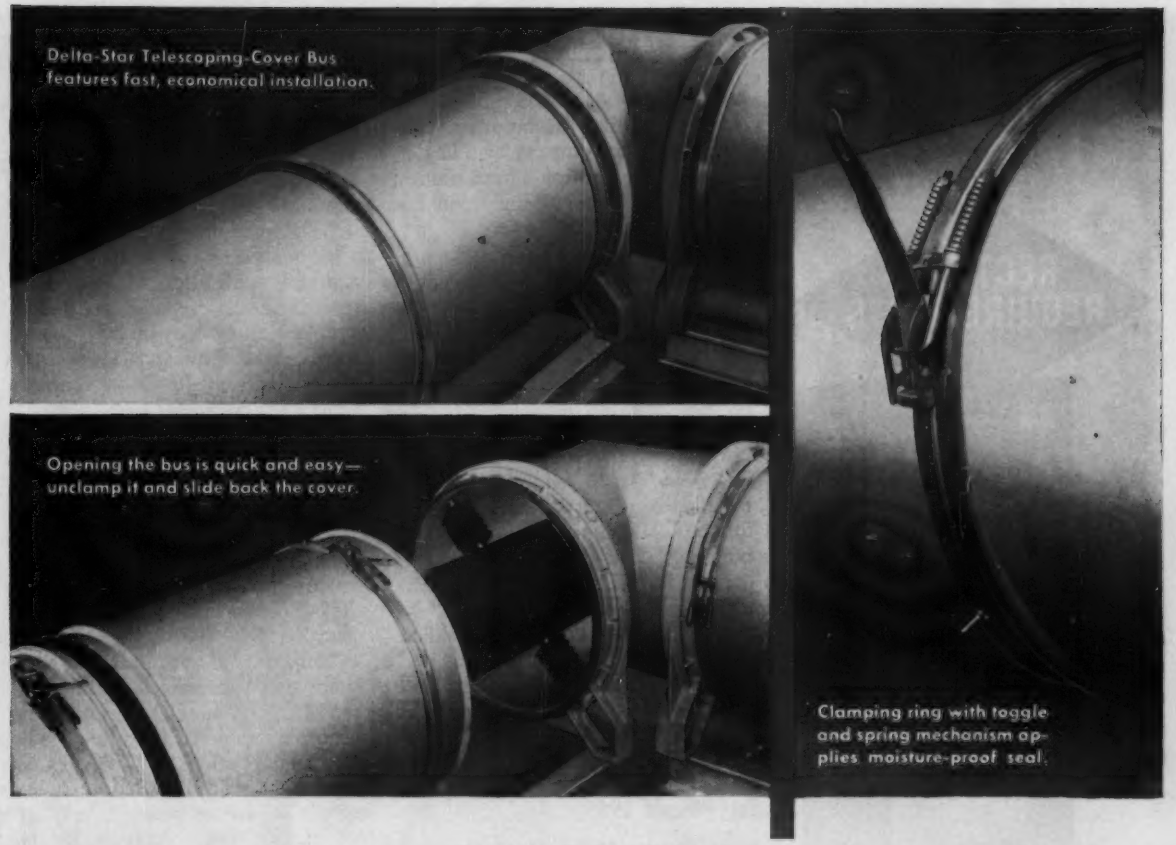
6. Noise—Because doors and windows are kept closed, annoying outside noises are reduced, assuring peaceful privacy.

7. Cost—Equipment investment is comparable to combined air conditioning and oil or gas heating. Operating costs are competitive.

8. Safety—There is no danger of fire, explosion, asphyxiation, fumes, soot or smoke. Use of electricity—the most modern form of energy—eliminates fuel storage, and the possibility of running out.

In our FPC-GP&L area, advertising is run in 27 newspapers. In these, at least one ad a month, from ¼ to ½-page size, stresses the benefits of heat pumps. During the summer, air conditioning and heat

(Continued on page 92)


Delta-Star Telescoping-Cover Bus features fast, economical installation.
Opening the bus is quick and easy—unclamp it and slide back the cover.
Clamping ring with toggle and spring mechanism applies moisture-proof seal.

When you're thinking about cost reduction, check Delta-Star's Telescoping-Cover Bus

From installation to maintenance you reduce time and costs with Delta-Star's telescoping-cover isolated phase bus.

Installation is greatly simplified—for speed and economy. Longitudinal sections 6 to 8 ft. long can be pre-assembled and delivered in lengths as large as your facilities can handle. Telescoping covers clamp into position—are locked together with a toggle and spring clamping mechanism—no bolts needed. Clamping rings with fully-trapped, self-sealing neoprene gaskets make the bus as water-proof as it is possible for a gasketed bus to be. Gasketing is at a minimum—no longitudinal gaskets required.

Telescoping-cover bus sections can be opened and inspected without tools—*in just a few minutes.* A 2 ft. 6 in. opening allows ample room for inspection and cleaning.

Current-carrying ability and minimum-heating characteristics of the telescoping-cover bus proved out very well in tests and in use.

For your new bus runs—or replacements—be sure to check Delta-Star's telescoping-cover bus.

Delta-Star Electric Division
H. K. Porter Company, Inc.
Chicago 12, Illinois
District offices in principle cities

HKP DELTA-STAR ELECTRIC DIVISION

H. K. PORTER COMPANY, INC.

Divisions of H. K. Porter Company, Inc. are: Connors Steel, Delta-Star Electric, Henry Disston, Laclede-Christy, Leschen Wire Rope, McLain Fire Brick, Quaker Rubber, Riverside-Alloy Metal, Vulcan Crucible Steel, W-S Fittings.

- **Selenium?**
- **Germanium?**
- **Silicon?**

You get all these *pluses* when you use Walker Rectifiers: low DC ripple — about 4% . . . low cost . . . long, efficient life . . . no maintenance. All Walker Rectifiers are designed and built to the highest standards, with the highest quality components.

With Walker Rectifiers you install them and forget them as far as maintenance or repair is concerned. Get full details on Walker Rectifiers — Selenium, Germanium or Silicon — write for complete details or engineering assistance.

NORMA-HOFFMANN
The Walker DIVISION
BEARINGS CORPORATION

THE WALKER DIVISION

NORMA-HOFFMANN
BEARINGS CORPORATION
Stamford, Connecticut

pump promotions are combined. All ads suggest that the customer contact either the company or a dealer. Ads do not mention brand names; dealers are urged to run tie-in ads near our ads.

This continuing campaign is supplemented by dealer activities. But for the most part, dealers promote heat pumps only during the summer season.

Promotion Has Paid Off Well

Results of our promotion efforts have been very good. As of June 30, 1956, 3,235 heat pumps were installed on the system. Of this total, 1,721 units are in commercial buildings, and 1,514 are in residences. In addition, 81 units are installed in company buildings.

Most of the units being installed use air as the heat source. This was true for 77% of all residential and 66% of all commercial central-type heat pumps installed during the first half of 1956. This compares with 67% and 21% respectively for the full year of 1955.

Heat Pumps Make More Money

Heat pumps have a higher load factor than other forms of heating and cooling. Thus, the revenue per kw of demand is the greatest. As shown in the chart, our company receives $36 per kw yearly from heat pumps, making them more profitable than other electric space heating and cooling loads.

Moreover, each properly installed unit forestalls competitive service to customers. Thus, it protects investments for serving existing loads and the accompanying revenues.

In analyzing customer troubles, incorrect application of equipment was the biggest cause of heat pump complaints. These usually result when over-enthusiastic dealers sell units that do not fulfill the requirements for a particular job.

For example, individual room units or central chilled-hot water systems are generally more satisfactory for hotels and motels than are central air systems. Proper installation permits balancing the system for each tenant's comfort, and still is able to maintain economical operation.

Complaints about residential heat pumps have been less numerous than for commercial installations because there have been fewer incorrect applications. Most types of heat pumps can be used satisfactorily in residences because the comfort of only one tenant or family need be considered.

Fewer complaints and more happy customers are direct results of careful and proper adjustments of equipment at the time it is installed. This has been our experience . . . we know that "An ounce of prevention is worth a pound of cure."

H & C BRIEFS

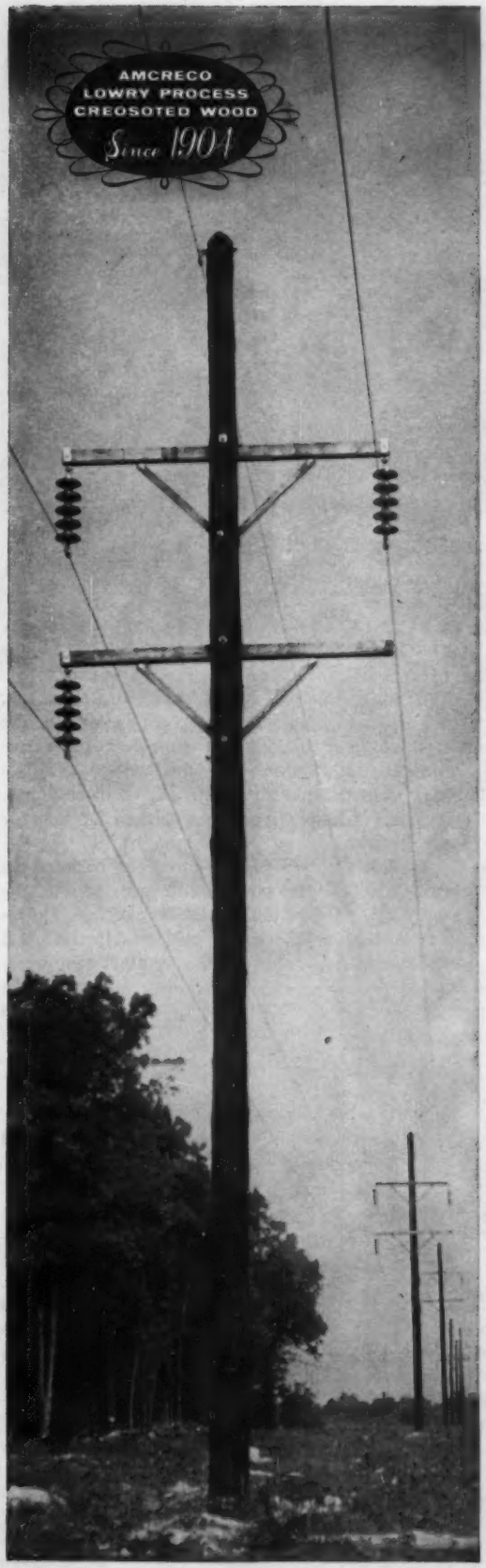
Let Customer Decide

"Is electric heat too expensive? Let's give the customer a chance to decide—with all the facts before him—in the light of his own interests and his own values," is the summation of an editorial appearing in the January, 1957, issue of Electrical Construction & Maintenance, a McGraw-Hill publication. EC& M said that active objections to electric heat, traditional load economics, and other subtle barriers are all in the customer's way, that such barriers should be removed, and the customer allowed to decide about electric space heating for himself.

All-Electric Homes in Fort Wayne

When Fort Wayne, Ind., Home Builders Assn staged their first "Parade of Homes", 9 of the 17 homes were electrically heated and equipped for all electric living. Five have ceiling cable, and one has forced-air wall units, two have baseboard convectors, and one has a heat pump. According to Roy L. McNett, vice president of the association, "The reaction of prospective home buyers has been more than I expected. Only one or two people asked about the cost." The homes are in the $15,000-$20,000 range.

(More Selling on page 94)



Why Creosote is Still the Miracle Wood Preservative

Creosote contains not just one but over one hundred ingredients that are toxic to insects, fungi and all other natural enemies of wood. That's one reason why it has been and still is the most effective wood preservative.

Of course, effective creosote treatment depends on the method of application. There must be careful scientific control at every step in the pressure treating process. During application, the preservative must be measured by precise equipment as it is forced into the wood. Final retention, distribution and concentration must be checked continually to assure the buyer of the best possible product. *This is the type of treatment that you get from Amcreco.*

If you've never been an Amcreco customer or if you've never profited by our years of experience and strategically located treatment plants and sales offices, contact us on your next job. We would appreciate an opportunity to quote your needs.

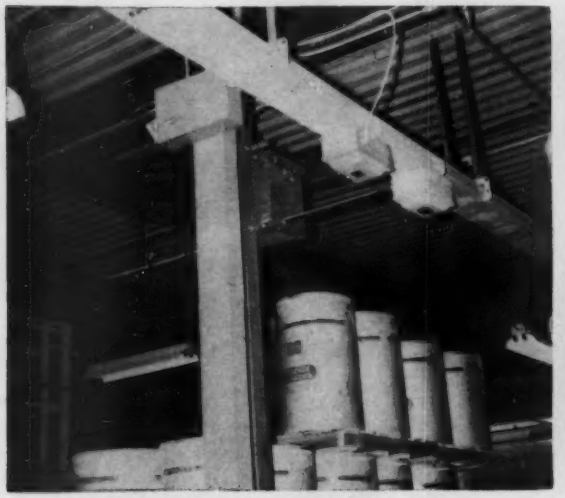
AMERICAN CREOSOTING CORPORATION

Colonial Creosoting Company
Federal Creosoting Company
Indiana Creosoting Company

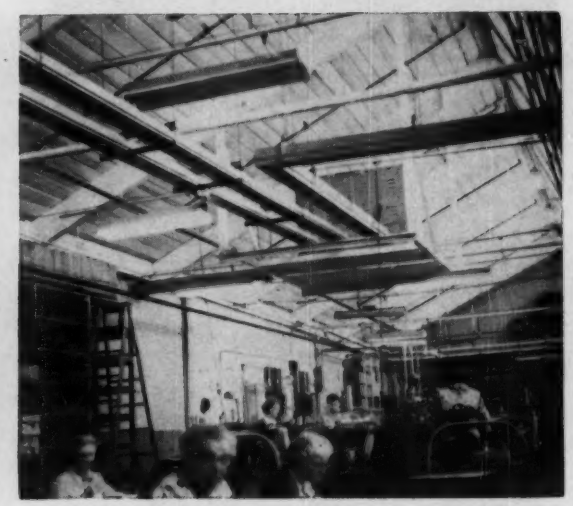
AMCREO
LOWRY PROCESS
CREOSOTED WOOD

Gulf States Creosoting Company
Georgia Creosoting Company
Kettle River Company

GENERAL OFFICES: LOUISVILLE 2, KENTUCKY



240-Volt Bus Duct in One Plant . . .



Aerial Substation in Second . . .

Boost Capacity Without Production Break

R. B. RUSSELL, Industrial Sales Engineer, Connecticut Light & Power Co, Willimantic, Conn.

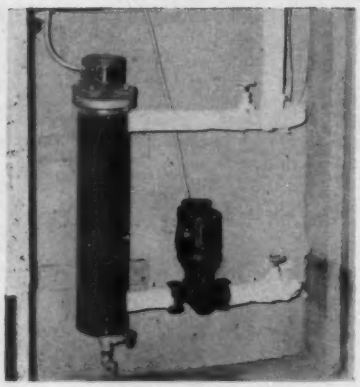
A new 240-v plug-in bus duct system, installed without interrupting production, and a new service entrance breaker smashed a critical power bottleneck and improved operating flexibility at the Electro Motive Mfg Co., Willimantic, Conn. electronic component maker. The new installation assures an adequate supply for all manufacturing areas and eliminates the hundreds of feet of rambling wiring used in the old distribution system.

Lighting, soldering pots, and ovens which need a 120-v supply are fed from local transformers. Small power and lighting panels are maintained where needed, eliminating long runs from a single central location. A 1600-amp air circuit breaker, connected to the power transformers outside by a custom-made bus duct, replaced the existing 600-amp service entrance

The new system replaced a 120/208 v, three-phase, 4-wire service. Change from one system to another was made by transferring the load bit by bit.

When load in another plant neared the capacity of the existing 2,000-amp service entrance, it was replaced with a 4,000-amp air circuit breaker. A 1,600-amp, low voltage drop, feeder bus, nearly 300 feet long, was installed to serve a new manufacturing area. This bus supplies 3 air circuit breakers, mounted on a suspended platform to save space. Each breaker feeds a plug-in bus.

Side Arm Assures Safe, Accurate Handling



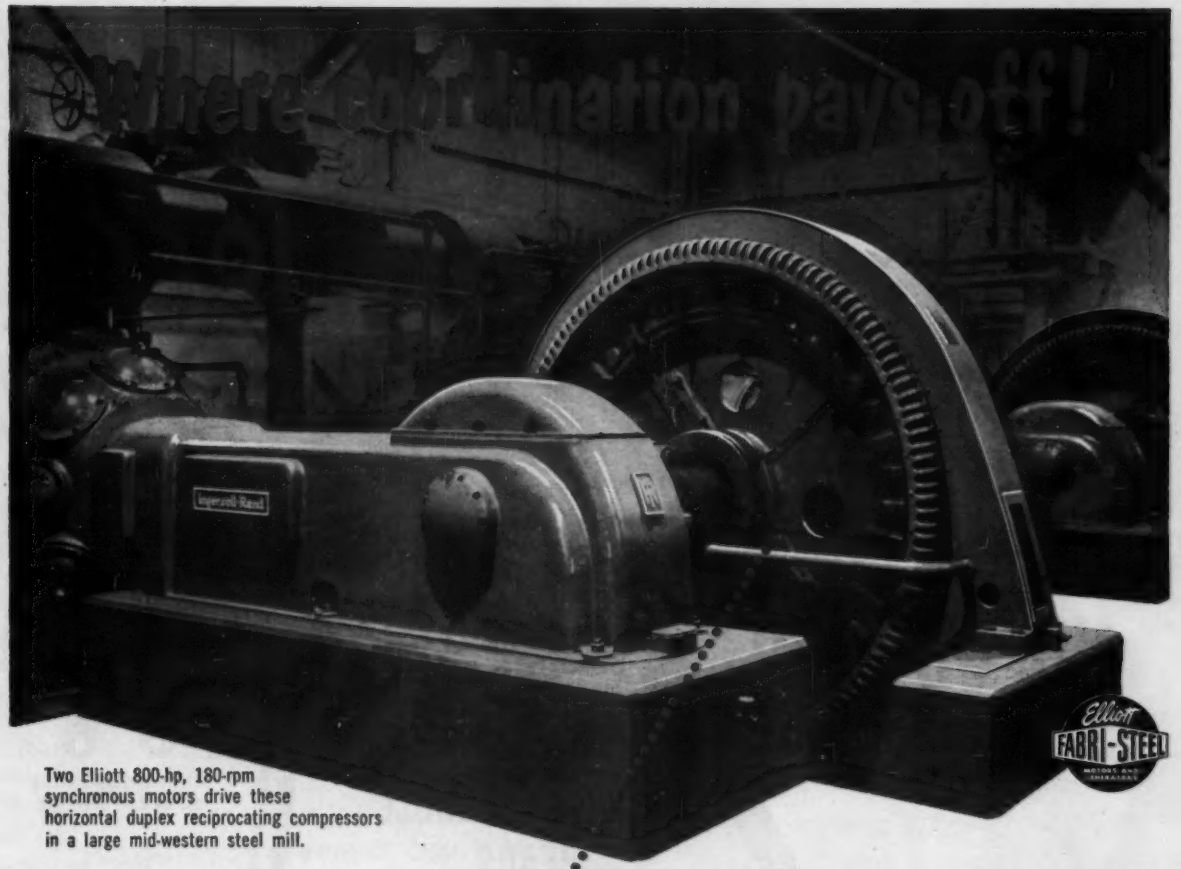
JAMES A. ACKERMAN, Power Sales Engineer, New York State Electric & Gas Corp., Lancaster, N. Y.

Smooth, uniform plastic coating with no hazard to personnel or plant are the result of an electrically heated plastic bath installed at the Scott Aviation Corp., Lancaster, N. Y. A thermostatically-controlled 6-kw sidearm heater, located in an adjacent room to minimize danger of explosions, holds a liquid 4:1 mixture xylol and isopnopyl alcohol within ±2.5 F of 140 F.

A circulating pump and insulated piping carry hot water from heater to tank.

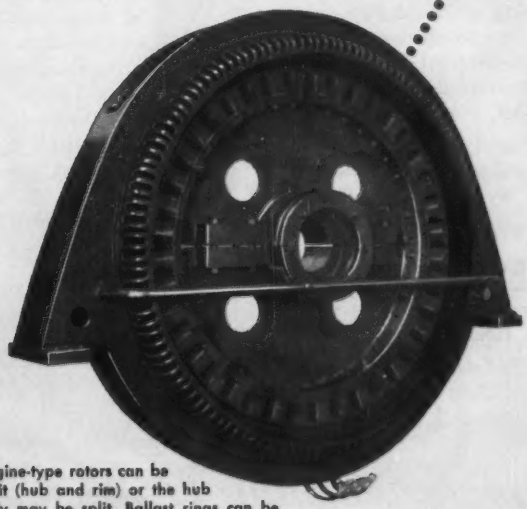
Used to coat aircraft control handles, the volatile plastic requires close temperature control. If the material is too hot, bubbles form on the work. When it is too cold, it becomes too viscous to produce a good coating. The hazardous location precludes open flames or arcing contacts.

The coating tank itself is a steel tank with an insulated water jacket. A hip-operated valve opens and closes the sliding glass covers, allowing the operator to use both hands to manipulate the work. An overhead mechanism dips the parts automatically.



Two Elliott 800-hp, 180-rpm synchronous motors drive these horizontal duplex reciprocating compressors in a large mid-western steel mill.

ELLIOTT SYNCHRONOUS MOTORS



Engine-type rotors can be split (hub and rim) or the hub only may be split. Ballast rings can be added when additional inertia is necessary

team up perfectly with compressors to assure top operating efficiencies. This teamwork is no accident. The complexities of compressor drives require the most careful engineering design and compressor application experience. Elliott has this background as attested by hundreds of successful installations. Such factors as starting torque and current, suitable flywheel effect, as well as power factor correction, are carefully analyzed. The result is the kind of performance that has earned a reputation for Elliott in large synchronous motor compressor drives. Contact your nearest Elliott Field Engineer for full details or write Elliott Company, Ridgway, Pa., for Bulletin PB 5000.

ELLIOTT Company

R5-4A

TURBINE-GENERATORS · TURBINES · MOTORS · GENERATORS · DEAERATING HEATERS · EJECTORS · CONDENSERS · COMPRESSORS · TURBOCHARGERS · TUBE CLEANERS · STRAINERS

NEW NICOPRESS NO. 88 TOOL with

INTERCHANGEABLE HEADS ARE QUICKLY ATTACHED

INTERCHANGEABLE HEADS

● This mechanical tool develops tremendous power by a combination of compound leverage and progressive ratcheting action. A few short strokes of the easy-working handle produce the powerful jaw pressure necessary to assure dependable full-tension splices.

Quickly-changed tool heads permit splicing a wide range of larger conductors. Write for Bulletin 88.

NICOPRESS . . . the tool and the sleeve that are made to work together . . . *together* they make the perfect splice.

Nicopress Sleeves and Tools Patented in U.S. and Foreign Countries. "Nicopress" Registered in U.S. and foreign countries.

The National Telephone Supply Company

5100 SUPERIOR AVENUE • CLEVELAND 3, OHIO

Canadian Mfr.: N. SLATER CO., LTD., HAMILTON, ONTARIO, CANADA

Export Distributor: INTERNATIONAL STANDARD ELECTRIC CORP., NEW YORK, N. Y.

THE NATIONAL TELEPHONE SUPPLY COMPANY

Time Switch

Types TGW 5, 6, and 7 off-peak control time switches, rated 35 amps, have molded nylon gear train assemblies and large contacts which reportedly increase their durability. Molded contact block assemblies are said to raise insulation level, simplify adjustment of gaps and contact blade pressures.

Clearly marked motor shafts, extending through the nameplate facilitate timing motor inspection. A marking arrow permits motor synchronism checks. Switches have single-unit triggers and arms, aluminum studs and shafts.

General Electric Co, Schenectady 5, N. Y.

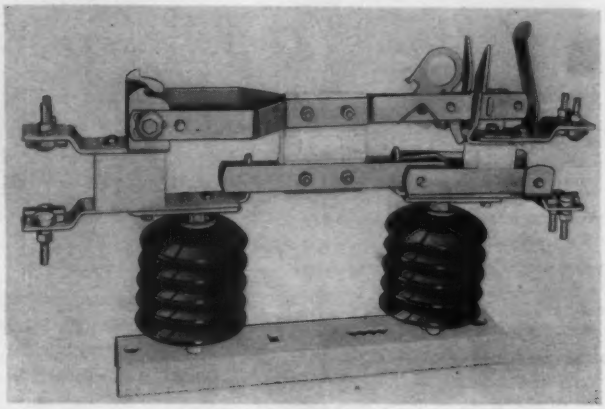
Regulator Bypass Switch

This voltage regulator bypass switch, rated 400 amp at 7.8 kv and 200 amp at 15 kv, is for regulators which can be set in neutral position. Each bypass replaces three disconnect switches.

Coordinated blade action shunts regulator before main contacts open and before magnetizing current is interrupted. Locking latch with hook-ring release holds switch closed.

Tin-plated terminals take copper or aluminum cable from No. 6 solid to 400 Mcm stranded. Current interchange points are silver-plated.

Line Material Industries, McGraw-Edison Co, Milwaukee 1, Wis.



Stick Tester

The Accu-Test is a two-part, wall-mounted unit, designed to test stick-type high voltage detectors. If the test stick is in operating condition, its tube lights when the stick is placed against a brass plate underneath the upper portion of the unit. Operating from a 110-v line, the Accu-Test provides the minimum voltage (1,000 v) at which the stick will operate, then shuts off automatically after one minute. The device mounts on the wall near the high voltage area and is permanently accessible.

Multi-Amp Corp, 465 Lehigh Ave, Union, N. J.

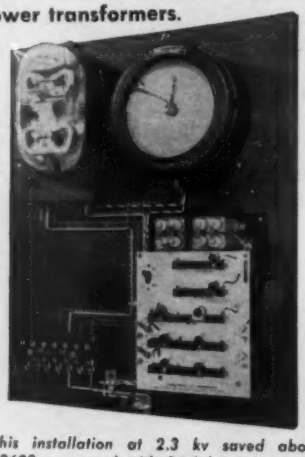
Guy Strand

Copperweld Type M guy strand is available in five strengths: 3-wire strand in 2,200 and 4,000-lb strengths; 7-wire strand in 6,000, 10,000 and 16,000-lb strengths. It comes in coils of 250, 500, and 1,000 ft, according to size. Reels

Transformer Loss Compensator

Saves you Money!

BECAUSE it provides an accurate means of measuring the energy and demands of high-voltage services at the low-voltage side of the power transformers.



This installation at 2.3 kv saved about $2600 compared with 34.5 kv metering; it saves about $5500 over metering at 69 kv.

THE TESCO compensator adds to the registration of the watthour meter an amount equal to the sum of the iron and copper losses of the transformer bank. It may be used with practically any type of watthour meter and . . . importantly . . . no changes are made in the meter itself, either structurally or in adjustments . . . It is produced in two and three element types for use with two-element or three-element meters on any type circuit.

Some of the Users . . .

Phila. Electric Co. Penna. Power & Light Co. Texas Power & Light Co. U. S. Bureau of Recl. Public Service Co. of New Hampshire. Utah Power & Light Co. Northern States Power Co.

Get your book now FREE

Detailed information on operation, installation, applications. Write for Bulletin NO. 63-A.

EASTERN SPECIALTY CO.

PHILADELPHIA 40, PA.

of 2,500 ft, 5,000 ft, and 10,000 ft are also available.

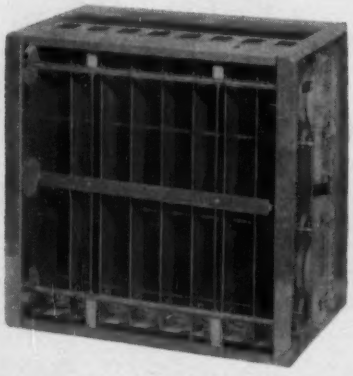
All wires have heavy copper sheath inseparately molten-welded to the alloy steel core. Said to be pliable, readily bent, served, moused, or clamped. Manufacturer reports smaller diameter wires meet strength specifications, make more economical guy strand possible.

Copperweld Steel Co, Frick Bldg, Pittsburgh 19, Pa.

Air Cleaner

Reduced in size, this Precipitron electronic air cleaner is designed to be used in the air conditioning systems of commercial buildings. It is reported to handle 600 cfm and remove 85 to 95% of the impurities. Installation is said to be quick and simple, since individual high-voltage wiring from cell to cell has been eliminated.

With spacing between collector

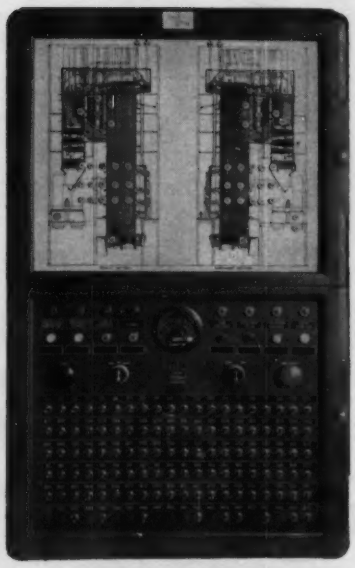


plates reduced, voltage gradient has been increased. Plates can now be washed automatically with cold water; a cold-water soluble adhesive is applied automatically to the plates after cleaning.

Westinghouse Electric Corp., Box 2278, Pittsburgh 30, Pa.

Soot Blower Controller

Selective-Sequence Controllers which can provide up to four repeat cycles in any sequence for each electrically driven soot blower and wall deslagger are available in two models. The SSC-120 has control stations for 120 soot blowers, the SSC-60 will handle 60 blowers. Both controllers are complete with master switch, selector switch, malfunction



interlocks, indicator lights, annunciators, and provisions for continuous timed blowing programs.

Sequence is set up internally with flexible patch cords. Front panel switches can be used to control individual blowers manually. Miniature lights on a cross-sectional boiler diagram light when individual blowers are working. For malfunctions such as loss of blowing medium, low header pressure, or motor overload, blowers may be retracted manually by pushing an emergency retract button. The complete sequence may be set to run automatically to completion, to recycle until stopped manually, or to operate from a timer clock on a 6, 8, 12, or 24-hr schedule.

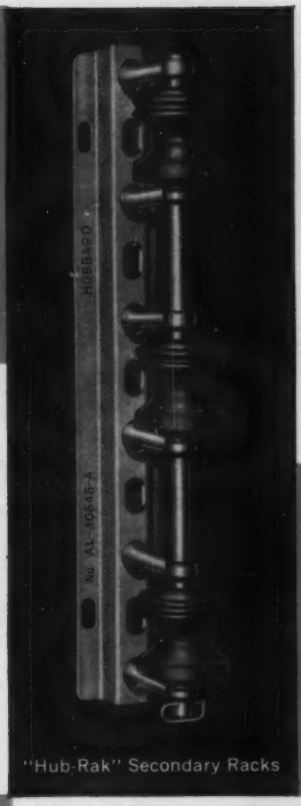
Copes-Vulcan Div., Blaw-Knox Co., Erie, Pa.

Service Enclosures

The redesigned Model AB120-1 and AB116-1 Stab-lock incoming service enclosures are sequence-bussed to meet field requirements for as many as nine 2-pole circuits. Block units are slotted to accommodate either two single pole, 15 or 20-amp, 0.5-in wide NC breakers or one single pole, 15 to 50-amp, 1-in wide, NA breaker. Common trip, 120/240-v breakers in ratings of 15, 20, 30, 40, and 50 amp can be used.

Federal Pacific Electric Co., 50 Paris St., Newark 1, N. J.

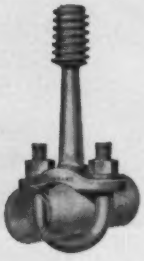
Conductor Clamps



"Hub-Rak" Secondary Racks

Thimbles

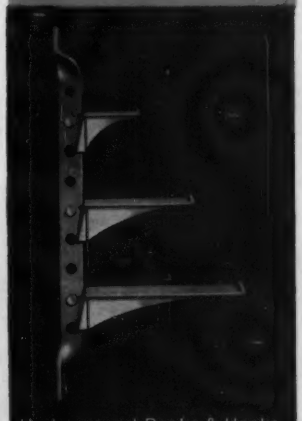
Guy Protector



Lamp Lead Brackets

Insulated Clevises

Pole Markers



Underground Racks & Hooks

Anchor Rod Bounding Clamps

HUBBARD aluminum hardware cuts corrosion costs

If you are faced with mounting corrosion costs in your service area, it will pay you to investigate Hubbard Aluminum Pole Line Hardware. This constantly growing line of hardware items was especially developed for application in corrosive atmosphere. To accomplish this, Hubbard combined the corrosion resistance, lightness and strength of special Aluminum Alloys with new fabricating techniques to produce hardware capable of long service life under extremely adverse conditions.

The special conditions of contamination in your area as well as other factors can be successfully overcome by the right choice of Pole Line Hardware Material. In addition to Aluminum Alloy, Hubbard Pole Line Hardware items are available in galvanized steel, Cor-Ten steel and special items in Copperweld steel. A Hubbard Hardware specialist will be glad to make a study of the atmospheric conditions which affect the service life of your pole line hardware in order to provide you with the type of hardware best suited to your needs.

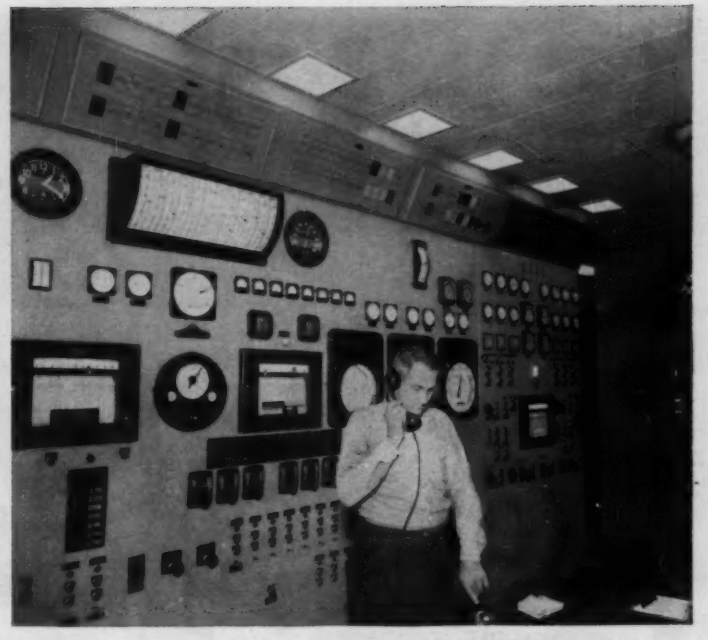
Sold exclusively through Electrical Distributors

HUBBARD AND COMPANY • 6301 BUTLER STREET, PITTSBURGH 1, PA.

Chicago, Ill.
Oakland, Calif.
Plano (Dallas), Texas

This turbo-generator at Oak Creek is a 120,000 KW, cross-compound, hydrogen-cooled unit. It consists of a 3600 RPM high pressure-intermediate pressure turbine driving an 80,000 KW generator, and an 1800 RPM low pressure turbine driving a 40,000 KW generator.

The fourth boiler and turbo-generator will be installed in the foreground. To the left of the building is a coal dock with storage capacity of a million tons. Coal is delivered by self-unloading Lake steamers which discharge at rate of 2,000 tons per hour.



In this control room at Oak Creek, Honeywell instruments measure, indicate, and record critical operating temperatures.

Wisconsin Electric's Newest Power Plant

has HONEYWELL *instrumentation to help harness 500,000 KW*

Located on Lake Michigan south of Milwaukee, Oak Creek Power Plant is Wisconsin Electric Power Company's newest, most modern station. Three units now in operation and a fourth under construction will bring the plant's total capacity to 500,000 KW. Additional future units are being planned at this location.

As in other outstanding power plants across the nation, Honeywell instrumentation figures prominently in the overall efficiency of Oak Creek. These accurate controls bring extra economy to the transformation of coal into kilowatts. Here, as in every Honeywell installation, service from the world's largest maker of automatic controls is close at hand for periodic maintenance and fast assistance in emergencies.

For experienced service in meeting your own instrumentation needs, call your nearby Honeywell sales engineer. He's as near as your phone.

MINNEAPOLIS-HONEYWELL REGULATOR CO., *Industrial Division*, Wayne and Windrim Aves., Phila. 44, Pa.—in Canada, Toronto 17, Ontario.

H HONEYWELL

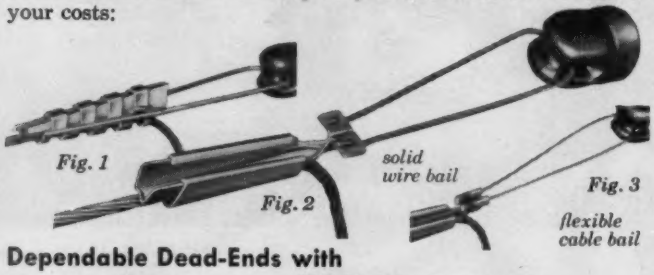
MINNEAPOLIS **Honeywell**

BROWN INSTRUMENTS

First in Controls

KEARNEY
POLE LINE ACCESSORIES
Save on Installation and Maintenance Costs

Here are just a few of the KEARNEY tested and field-proved Pole Line Accessories which speed your construction . . . reduce your costs:



Dependable Dead-Ends with WEDGE-TITE CLAMPS

Simple, economical . . . for bare neutral self-supporting service cable. Develop high holding strength to safely support span. One-piece clamps (Fig. 1) are constructed so parts can't become separated during installation. Time-saving two-piece clamps (Fig. 2 and 3) do not require neutral to be threaded through clamp.

Neat, Compact LAY-CIT CABLE GRIPS

For aerial and service cable. Double-gripping action of aluminum Lay-Cit plates and extra holding power of their knurled inner surfaces make this clamp particularly efficient on modern synthetic-jacketed cables.

Simple, Inexpensive SPAN CLAMPS

Dead-end service wire to bare neutral of secondary in mid-span. To install, slip clamp on secondary neutral, tighten single bolt.

Easily Installed SERVICE CABLE TIES

Secure insulated wires to bare neutral, preventing separation of conductors. Soft aluminum; install with fingers.

154

JAMES R. KEARNEY CORPORATION, *General Offices:* **4224-42 Clayton Ave., St. Louis 10, Mo.**

for BETTER CONSTRUCTION SAFER MAINTENANCE *Specify* **KEARNEY PRODUCTS**

Plants at: ST. LOUIS • FAYETTEVILLE, ARK. • SHENANDOAH & CLARINDA, IA. • GUELPH, ONT., CAN.

More New Products

General Electric Co, Schenectady 5, N. Y., has Form G **door operator motors** in ratings from 1/6 to ¾ hp at 1725 rpm. Instantly reversible and reversing-from-stand-still models; said to resist moist-air conditions.

Thor Power Tool Co, Aurora Ill., has developed a sound squelching **Muffle cover** which is said to reduce air hammer noise intensity up to 55%. Inner and outer jackets of sound proofing material zip around the paving breaker, reduce exhaust noise and clang of piston hammer.

Killark Electric Mfg Co, Vandeventer and Easton, St. Louis 13, Mo., offers a SFL-38 **sealed beam floodlight** for areas subject to moisture or moisture vapor. Said to be adjustable to any angle, weatherproof in any position.

Electron Arc, Inc, 244 Broad St., Lynn, Mass., markets 2, 10, 25, 100 and 300-w **power supplies** for Zirconium enclosed concentrated arc high intensity lamps.

Tork Time Controls, Inc, Mount Vernon, N. Y. has available single-pole light and power (1191) and program (801) **switches** for 440-v motors.

Ingersoll Rand, 11 Broadway, N. Y. 4, N. Y. markets an electric **wire-wrapping hand tool** for making solderless connections in electrical and electronic assemblies. Handles gauges 20 to 24.

Ohio Carbon Co, 12508 Berea Rd, Cleveland 11, Ohio, has a D series of **brushes** of electrographitic lamp black for modern heavy duty ac and dc motors and generators.

Yellow Springs Instrument Co, Inc, Yellow Springs, Ohio, offers a Model 63 precision **temperature controller** in several ranges from −100 to +500 F. For calibrating baths, oven extruders, and press platens.

American Silver Co, Inc, 36-07 Prince St, Flushing 54, N. Y., has electrical **contact materials** composed of a thin contact surface of silver, gold, platinum, palladium or their alloys on a core of steel or other base metal. Five varieties, including button and disc forms; gauges to ultra-thin.

W. A. Plummer Mfg Co, 752 S. San Pedro At, Los Angeles, Cal., offers Zippertubing **zipper style plastic tubing** for enclosing multiconductor wiring in the electrical and electronic indutsries.

Statham Development Corp, 12411 W. Olympic Blvd, Los Angeles 64, Cal., has a mode TC-4 **temperature test chamber** for temperature ranges from −65F to +600F. Product capacity, 600 cu in.

General Electric Co, Coshocton, Ohio, offers Textolite cold punch 11572 paper base, high insulation resistant **plastic laminate** for printed circuits and other electronic applications using high voltage rf. Available unclad, or with 1 or 2-oz copper on one or both sides.

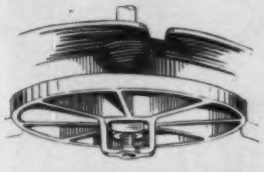
Jordan Co, Inc, 3235 W. Hampton Ave, Milwaukee 9, Wis., has a Dialtrol follow-up type **remote positioning control,** with a vernier for positioning valves, jacks, rheostats, variable speed drive controls, etc.

Trio Laboratories, Inc, Seaford, N. Y., has a Model F panel-mounting d-c **vacuum tube voltmeter** with a range of 0.5 to 300 volts, a 10-megohm input impedance, and a reported accuracy of 2%. Available in zero center or zero left styles; operates from 115-v, 60-cps or 400-cps line.

W. C. Dillon & Co, Inc, 14620 Keswick St, Van Nuys, Cal., offers a remote indicating **dynamometer** with a 10-in. dial. Capacities from 500 to 100,000 lb in 13 sizes.

Roto-Scraper Co, 2960 W Valley Blvd, Alhambra, Cal., offers the Roto-Scraper **rotating scraper,** an electric hand tool for removing paint, mill scale or rust from metal, brick, stone or other masonry surfaces.

You can depend on KEARNEY Expansion Anchors to develop published holding power! Blade contour is specially designed and engineered to provide extra holding power right where it's needed most—by resisting pull outward against the earth as well as upward. 63% of the expanded blade area lies securely under undisturbed earth because the blades expand easily without disturbing surrounding earth. Anchor discs, against which the expanded blades *lock*, are rugged, heavily reinforced. KEARNEY Expansion Anchors are available in 2, 3 and 4 blade types . . . and they're easy to install!



Rod can't slide through disc because recessed disc socket retains nut, enables rod to be easily salvaged.

355

JAMES R. KEARNEY CORPORATION, *General Offices:* **4224-42 Clayton Ave., St. Louis 10, Mo.**

for BETTER CONSTRUCTION
SAFER MAINTENANCE
Specify **KEARNEY PRODUCTS**

Plants at: ST. LOUIS • FAYETTEVILLE, ARK. • SHENANDOAH & CLARINDA, IA. — GUELPH, ONT., CAN.

Put WARN HUBS on your 'Jeep'®

Stop Front Drive Wear in 2-Wheel Drive

Warn Hubs on your 4 w.d. will reduce front drive wear *in exact proportion to the miles you drive in 2 w.d.!* Watch your mileage, and you will find that you use 2 w.d. *most of the time.* With Warn Hubs, the front drive is "idle" in 2 w.d.—nothing turns but the wheels. There is no wear, no drag, no front gear whine. Your 4 w.d. has more pep, speed and power in high, and steers easier.

For maximum convenience, install Warn Lock-O-matics. They *automatically* engage the front wheels for 4-wheel drive, and disengage them for free-wheeling 2-wheel drive, *as you shift!* Warn Locking Hubs have easy fingertip controls. With either model, you'll get better, more economical service from your 4 w.d. See your local 4 w.d. dealer today. Free literature.

APPROVED MODELS FOR ALL 4 W.Ds. TO 1½ TONS

WARN MFG. CO. Riverton Box 6064-EW3, Seattle 88, Wash.

PAGE chain link FENCE

America's First Wire Fence—since 1883

Here's how to be sure PAGE Fence will be the RIGHT Fence for YOU

You are invited to write for a file-size folder packed full of information that's essential when making decisions leading to the fence that's BEST FOR YOU. Ask for Folder DH-26.

• When you need a fence it will be much to your advantage to have full knowledge of the many choices of component parts that PAGE provides. You can choose from 8 heights—4 fabric metals—2 types of metal posts—6 styles of gates. All these and other features are pictured and described in the folder offered above. It also supplies facts about the PAGE localized engineering and erecting service that assures highest grade workmanship and lasting satisfaction. Page Fence Association members, located in more than 100 cities, are listed in Folder DH-26. See that list for name of member nearest you.

Write to PAGE FENCE ASSOCIATION in Monessen, Pa., Atlanta, Bridgeport, Chicago, Denver, Detroit, Houston, Los Angeles, New York, Philadelphia or San Francisco.

PRODUCT OF PAGE STEEL & WIRE DIVISION OF AMERICAN CHAIN & CABLE COMPANY, INC.

CATALOGS—BULLETINS

• **ALL-METAL LIQUID FILTERS:** LFC Catalog on all-metal liquid filters gives complete data for designers and users of equipment requiring full flow filtration of lubricating, hydraulic or fuel oils. Write Air-Maze Corp, 25000 Miles Road, Cleveland 28, Ohio.

• **COMPANY HISTORY AND BACKGROUND:** A 40-page color brochure, published on the occasion of the firm's 65th anniversary, gives the history, range of services and pictures of some of the installations of Sargent & Lundy. Write Sargent & Lundy, Public Relations Dept, Chicago 3, Ill.

• **EMERGENCY LIGHTING EQUIPMENT:** Its line of emergency lighting equipment is covered in the 1957 Catalog issued by Electric Cord Co, 195 William Street, New York 38, N. Y.

• **LABORATORY COAL CRUSHERS:** "Better Testing and Small Scale Reduction" is the name of a bulletin which describes the laboratory crushers used to prepare coal samples necessary for experimental and marketing use. Write American Pulverizer Co, 1249 Macklind Ave, St. Louis 10, Mo. Ask for Bulletin No. 157.

• **MOTOR SELECTION:** A 12-page "application guide", said to make the selection of electric motors for all popular applications easy, has been published by Century Electric Co, 1806 Pine Street, St. Louis, Mo. Ask for Application Guide No. 102.

• **'TEFLON' TUBING:** T-200 is the designation given the new 2-page bulletin describing the thin-walled Teflon tubing made by Haveg Industries, Inc, Wilmington 8, Del.

• **POTENTIOMETER:** Data Sheet E-51(6) lists complete specifications and typical laboratory applications of the Type K-3 Universal (Guarded) Potentiometer manufactured by Leeds & Northrup Co, 4934 Stenton Ave, Philadelphia 44, Pa.

• **POWER FUSING UNITS:** "Selecting SMD Fuse Units" is the name of a folder of graphs and charts for use in selecting power fuse units. Material covers interrupting ratings, amp rating selections, coordination, preloading adjustments, ambient adjustments, cooling time and overload operation. Write S & C Electric Co, 4435 Ravenswood Ave, Chicago 40, Ill. Ask for Data Bulletin 262.

• **SYNTHETIC RUBBERS:** "The DuPont Elastomers" is the name of a descriptive booklet covering the manufacturers' NEOPRENE and HYPALON synthetic rubbers. Available from E. I. DuPont & Co, Public Relations Dept, Wilmington 98, Del.

• **WELDING ELECTRODES:** A 24-page Electrode Data Book includes information on AWS-ASTM arc welding specifications; how to estimate electrode consumption; summary of welding symbols; factors in selecting electrodes and other data of interest to users of arc welding. Copies of the book (NH-504) are available from National Cylinder Gas Co, 840 N. Michigan Ave, Chicago 11, Ill.

New Forward Control Design provides more space because the engine is behind you. It puts a 74" pickup box on 81" wheelbase—record-breaking cargo space per inch of wheelbase. This efficient design makes maneuvering through rough terrain faster and safer.

How the New Forward Control 'Jeep' FC-150 saves time and money on service jobs!

All-Wheel Traction. With the extra traction of its 4-wheel drive, the FC-150 travels through mud, and climbs hills as steep as 65% . . . in good weather or bad. Yet, it shifts easily into 2-wheel drive for highway travel at top legal speeds.

On job after job, 24 hours a day, the all-new Forward Control 'Jeep' FC-150 helps assure uninterrupted electrical service, with savings of time and manpower. That's because it's made to order for electrical industry service jobs.

Here's a 4-wheel drive truck that gives you maximum cargo space on minimum wheelbase. It maneuvers through heavy brush, mud or snow, with crew and equipment, where ordinary trucks call it quits. Riding comfort!—you have to test drive it to believe it! There's plenty of head, leg, and shoulder room! The all-new Safety-View cab lets you see terrain as close as 6 feet from the front bumper. It combines with the new wrap-around windshield—largest in the FC-150 weight class—for up to 200% greater forward visibility. And with power take-off, the FC-150 operates a wide variety of special equipment from winches to trenchers.

The new 'Jeep' FC-150, G.V.W. 5,000 lbs., is powered by the economical engine that made 'Jeep' vehicles famous. It combines with a new 16-gallon gas tank to let you cruise up to 300 miles on *one* filling. See your 'Jeep' dealer for a demonstration today!

There's a 4-Wheel-Drive 'Jeep' vehicle for your job!

Universal 'Jeep'

'Jeep' Truck

'Jeep' Utility Wagon

'Jeep' Forward Control 4-Wheel-Drive FC-150

WILLYS . . . world's largest makers of 4-Wheel-Drive vehicles

WILLYS MOTORS, INC., TOLEDO 1, OHIO

MEETINGS CALENDAR

MARCH

National Rural Electric Cooperative Association—Annual Meeting, Conrad Hilton Hotel, Chicago, Ill., Mar. 4-7.

Louisiana State University—Annual Conference on High-Speed Computers, Baton Rouge, La., Mar. 5-8.

Electric Companies Public Information Program—Inter-Regional Committee, President Hotel, Kansas City, Mo., Mar. 7; Steering Committee, New York, Mar. 14.

Street Tree and Utility Conference—Hotel Cleveland, Cleveland, Ohio, Mar. 7-8.

Engineers Joint Council—2nd Nuclear Engineering and Science Conference; 3rd International Atomic Exposition, and 5th Hot Laboratories and Equipment Conference, Convention Hall, Philadelphia, Pa., Mar. 11-15.

National Association of Corrosion Engineers—Annual Convention, Kiel Auditorium, St. Louis, Mo., Mar. 11-15.

National Electrical Manufacturers Association—General Engineering Committee, Switch and Enclosed Breaker Section, Chase Hotel, St. Louis, Mo., Mar. 13; Panelboard and Distribution Board Section, Molded Case Breaker Section and Busway Section, Chase Hotel, St. Louis, Mo., Mar. 14.

• **Canadian Electrical Association**—Western Zone Meetings, Hotel Vancouver, Vancouver, B. C., Mar. 18-20.

Institute of Radio Engineers—Annual National Convention and Radio Engineering Show, Waldorf-Astoria Hotel and New York Coliseum, Mar. 18-21.

American Society of Mechanical Engineers—Gas Turbine Conference, Sheraton-Cadillac Hotel, Detroit, Mich., Mar. 18-21; Engineering Management Conference, Pittsburgh, Mar. 27-28.

Edison Electric Institute—Industrial Relations Committee, EEI Headquarters, New York City, Mar. 21.

Electric Meter Institute—Eighth Annual Session, University of Denver, Denver, Colo., Mar. 25-29.

American Power Congress—19th Annual American Power Conference, Hotel Sherman, Chicago, Ill., Mar. 27-29.

Oklahoma Utilities Association—Annual Convention, Hotel Tulsa, Tulsa, Oklahoma, Mar. 28-29.

Illuminating Engineering Society—Pacific Northwest Regional Conference, Empress Hotel, Victoria, B. C., Canada, Mar. 28-30.

APRIL

Edison Electric Institute—Industrial Power and Heating Committee, Edgewater Beach Hotel, Chicago, Ill., April 1; Sales Conference, Edgewater Beach Hotel, Chicago, April 1-4; Accounting Division Advisory and Executive Committee, Madison Suite, Sheraton Park Hotel, Wash., D. C., April 8; National Accounting Conference of Electric & Gas Utility Accountants, held jointly with AGA, Washington, D. C., April 8-10; Industrial Relations Committee, jointly with Personnel Sections of Indiana Electric Assn and Ohio Electric Utility Institute, and Personnel Practices Committee of Pennsylvania Electric Assn., Netherland Plaza Hotel, Cincinnati, Ohio, April 18-19; Meter and Service Committee, Soreno Hotel, St. Petersburg, Fla., April 24-26; Purchasing and Stores Committee Executive Committee and 10th Annual Meeting, Penn Sheraton Hotel, Pittsburgh, Pa., April 28-May 1, Insurance Committee, Williamsburg Inn, Williamsburg, Va., Apr. 29-30; Accident Prevention Committee, Algiers Hotel, Miami Beach, Fla., April 29-May 1.

Southeastern Electric Exchange—24th Annual Conference, Boca Raton Hotel and Club, Boca Raton, Fla., April 1-3.

National Industrial Conference Board—8th Atomic Energy Courses for Management, Rye, N. Y., April 1-6.

Indiana Electric Association—17th Annual Young Men's Utility Conference, Terre Haute House, Terre Haute, Ind., April 3-4.

• **American Institute of Electrical Engineers**—Southern District Meeting, Heidelberg Hotel, Jackson, Miss., April 3-5; Great Lakes District Meeting, Hotel Fort Des Moines, Des Moines, Iowa, April 15-17; Third Biennial Conference on Electric Heating, sponsored jointly by AIEE and the Toledo section of AIEE, Commodore Perry Hotel, Toledo, Ohio, April 23-24.

Missouri Valley Electric Association—Engineering Conference, Hotel President & Municipal Auditorium, Kansas City, Mo., April 3-5.

Northwest Public Power Association—Annual Membership Meeting, Benjamin Franklin Hotel, Seattle, Wash., April 3-5; Engineering and Operations Section, Tacoma Utility Center and Winthrop Hotel, Tacoma, Wash., April 23-24.

American Society of Mechanical Engineers—Spring Meeting, Dinkler-Tutwiler Hotel, Birmingham, Ala., April 8-10.

Northeast Missouri Electric Power Cooperative—Eighth Annual REA Electric Generating Plant Operation and Maintenance Conference, Phillips Hotel, Kansas City, Mo., April 8-11.

National Electrical Industries Show—Fourth National Electrical Industries Show, 71st Regiment Armory, Park Ave and 34th St., New York City, April 8-11.

Institute of Radio Engineers—First Annual Conference on Electronics in Industry, Illinois Institute of Technology, Chicago, Ill., April 9-10.

American Welding Society—Fifth Welding Show, Convention Hall, Philadelphia, Pa., April 9-11.

Electrical Engineers (ASEE) Exhibition, Ltd—Sixth Electrical Engineers Exhibition, Earls Court, London, England, April 9-13.

• **Pennsylvania Electrical Association**—Meter Committee, Garden City, Long Island, New York, April 11-12.

Maryland Utilities Association—Annual Spring Business Conference, Lord Baltimore Hotel, April 12.

Agricultural and Mechanical College of Texas—Tenth Annual Conference for Protective Relay Engineers, A&M College of Texas, College Station, Tex., April 15-17.

Rocky Mountain Electrical League—Spring Conference, Shirley-Savoy Hotel, Denver, Colo., April 21-24.

Association of Edison Illuminating Companies and Edison Electric Institute—Meter and Service Committee, Soreno Hotel, St. Petersburg, Fla., April 24-26.

• **Northwest Electric Light & Power Association**—Engineering and Operating Section, Sun Valley, Idaho, April 24-26.

• **Institute of Radio Engineers**—Eleventh Annual Technical Conference on Television, Cincinnati Engineering Society Bldg., Cincinnati, Ohio, April 26-27.

MAY

• **Edison Electric Institute**—Transmission and Distribution Committee, Muehlebach Hotel, Kansas City, Mo., May 2-3; Prime Movers Committee, Tides Hotel St. Petersburg, Fla., May 6-8; Industrial Relations Committee, EEI Headquarters, New York City, May 16; Electrical System and Equipment Committee, Statler Hotel, Buffalo, N. Y., May 20-21; Accounting Division Time and Place Committee jointly with AGA, AGA Headquarters, New York City, May 22; Financing and Investor Relations Committee, Edgewater Beach Hotel, Chicago, Ill., May 31-June 1.

• **Pacific Coast Electrical Association**—Annual Convention, Fairmount Hotel, San Francisco, Calif., May 15-17.

• Additions this week.

Your Westinghouse representative can prove . . .

20% INCREASED OVERLOAD CAPACITY

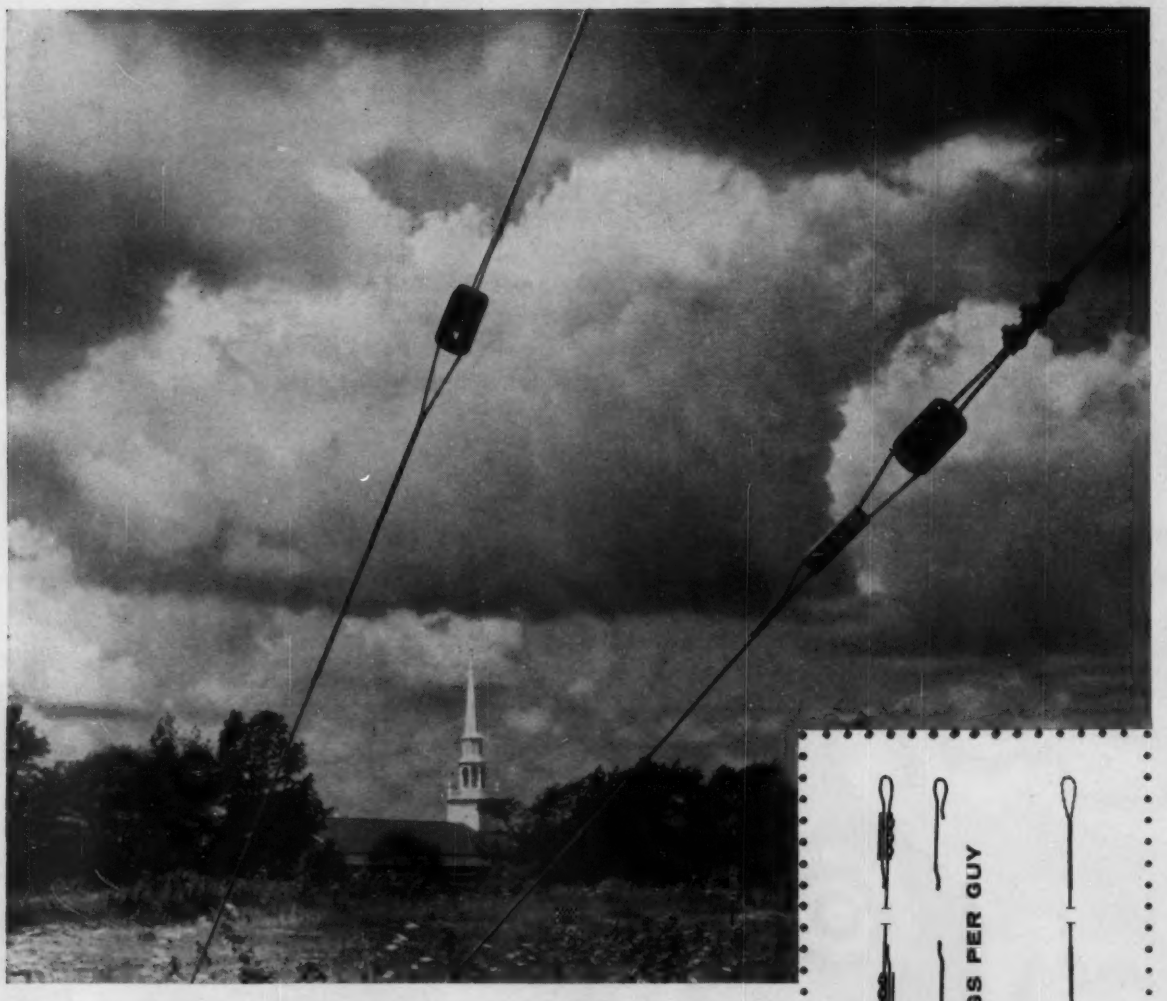
in all new Westinghouse distribution transformers *without sacrifice of service life!* The evidence is several thousand Westinghouse transformers with increased breaker settings put on Union Electric's lines, many since 1954, without a single burnout.

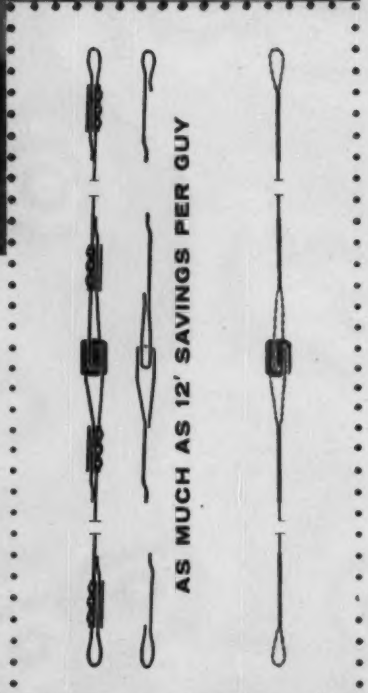
YOU CAN BE SURE...IF IT'S

Westinghouse

W. R. McMillan, Supt. Distribution, Union Electric Co., one of three utilities who joined Westinghouse for this major development, with Cooper Slay, St. Louis Westinghouse representative. "Higher Westinghouse transformer breaker settings have meant a decided decrease in breaker trip-outs with no loss of transformer life" . . . Mr. McMillan.

J-70788





PX-80

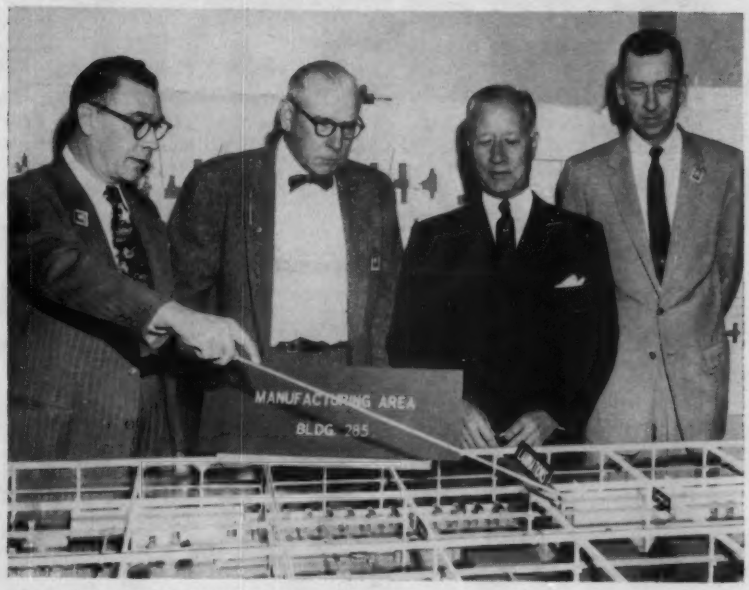
Up to 30% savings in strand... with PLP Guy-Grip Dead-Ends

You will find real guying economy with PLP Guy-Grip dead-ends. Because they eliminate strand looping, you can use *shorter, straight* lengths of guy strand. This means as much as 12 feet savings in strand per guy. What's more, the finished installation is neat, streamlined, efficient.

Made in accordance with or for use under U. S. Patent No. 2,761,273; other patents issued and pending.

PREFORMED LINE PRODUCTS CO.

5349 ST. CLAIR AVENUE • CLEVELAND 3, OHIO
DEPT. NO. PR1B
Telephone: Cleveland EXpress 1-3571



SCHENECTADY EXPANSION plans for 1957 are previewed by GE's President Ralph J. Cordiner, third from left. Budget of $28 million is slated here. He's hearing about Large Steam Turbine-Generator Dept plans from F. E. Jaquinto (l), facilities specialist; Gen. Mang W. E. Saupe; H. R. Hill, manufacturing manager

GE Sales Reach $4 Billion

General Electric Co hit new highs last year in sales, corporate and employee earnings, payments to suppliers, dividends, and in expansion of facilities, Pres Ralph J. Cordiner announced recently.

The company's earnings of $213,756,849, while setting an all-time high, did not keep pace with an 18% increase in sales, Cordiner said. "The unfavorable price situation in the electrical manufacturing industry" was a factor in generally low operating margins.

Spending for Schenectady, N. Y., expansions will reach $28 million this year. The outlay represents a 44% increase over 1956 additions and modernization. Of this, $8.5 million is budgeted for the large steam turbine-generator department. Last year the company's total construction expenses amounted to $205,215,636.

Cordiner said 1956 sales totaled $4,090,015,685 compared with $3,463,734,419 in 1955. He emphasized his expectation that GE sales would double in the next eight years, which rate will continue the record doubling that took place since 1948.

Earnings last year were 2% above $208,908,054 profits in 1955. This was equivalent to $2.46 a share or 5.2¢ per dollar of sales versus $2.41 a share and 6¢ per sales dollar in 1955.

Dividends in 1956 totaled $2 a share and involved a $172,245,845 pay-out. In the previous period dividends were $1.60 a share and distribution $137,189,002. Number of shareowners gained 18,680 for a year-end total of 366,524.

Employee earnings and benefits reached $1,643,818,495 last year. Of 280,407 employees, more than 52,000 present or past workers earned dividends through GE's stock bonus plan. Another 77,000 now in the process of becoming share owners had dividends set aside.

Purchases of materials, supplies, and services from suppliers hit a peak of $1,992,715,548 or 48% of each sales dollar, Cordiner said. Provision was made for payment of nearly $260 million in direct federal, state, local, and Canadian taxes and renegotiation.

Cordiner cited other factors causing the lag in the earnings-sales ratio. These include the high level of extra costs involved with expansion, and continuing high levels of spending for research and development.

Square D Reports Sales Over $100 Million in 1956

Square D Co reports that its annual sales were more than $100 million in 1956. This is about a 28% increase from the previous year's record high of $78 million.

New plants being constructed are at Glendale, Wis.; Lexington, Ky.; and Atlanta, Ga. Modernization of existing facilities is in process at Detroit, Peru, and other locations.

Arrangements have been made through the National Bank of Detroit, according to a company spokesman, to borrow up to $10 million if necessary, to carry out present expansion plans.

Union Metal Supplies Sign Mounting on NY Thruway

Overhead signs on the New York Thruway now number 22 installations. The tapered one-piece upright Monotube poles and beam segments are products of the Union Metal Mfg Co, Canton, Ohio. Additional single and double span structures are planned.

Internally illuminated "over the road" signs are wired through the steel poles and crossbeams. All signs have plastic faces, including those of plywood with reflective lettering. Letters are 18 in. high for single-line copy, and 10-in. high for two lines with signs 48 in. high.

U. S. Aluminum Production

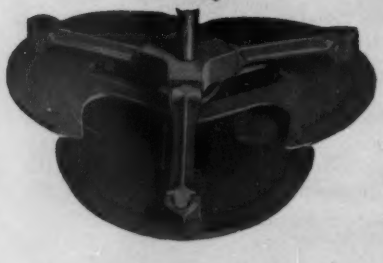
U. S. primary aluminum production amounted to 147,030 tons in January, according to the Aluminum Association, New York. This

(Continued on page 110)

The Old Reliable

EVERSTICK ANCHORS...

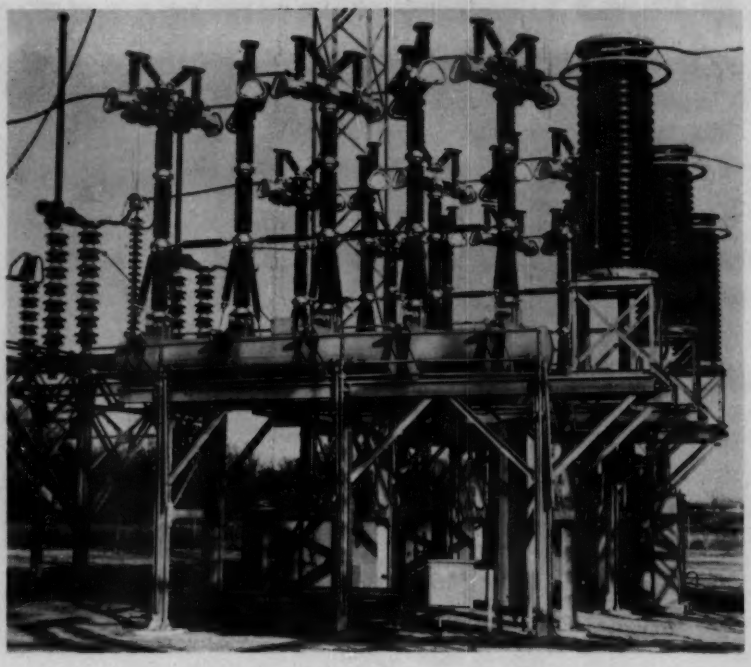
EXTRA Holding Power
QUICKLY Installed
TOUGH For long life



● They speed up work and provide dependable anchorage in new construction and maintenance. Quick and easy to install—made of tough rust-resistant malleable iron—their holding power "tops" all other. Available two-way, three-way, four-way, and cone types. Write for facts.

AN EXCLUSIVE EVERSTICK FEATURE
Exclusive Everstick nut housing Locks anchor firmly on rod. No chance of rod slipping thru anchor.

EVERSTICK ANCHOR CO
FAIRFIELD, IOWA



345-Kv Airblast Breakers in Operation

Two high-speed compressed air breakers are in service on American Gas & Electric's 345-kv system. The airblast circuit breaker illustrated is at the Lima, Ohio, plant of Ohio Power Co; second is at Sorenson, Ind., substation in the Indiana & Michigan Power Co territory.

These breakers are rated 2,000 amp continuous, 25 million kva interrupting capacity, at 350 kv. Opening speed is 3 cycles. They were manufactured by Brown Boveri Corp and are reported to be the largest of this type installed in the United States.

The three-phase breaker is controlled electrically and operated pneumatically with air supply from a 270 cu ft storage tank. Rated air pressure is 215 psig and the range is 175 to 225 psig. Sufficient air is available to complete six close-open cycles before the breaker ceases to operate, assuming the air compressor is not functioning.

The breaker is operated through a number of elements coupled pneumatically. Air from the tank passes up through the porcelain insulators to the T-bar. Here the air operates enclosed contacts. Arc interruption is facilitated by enclosed auxiliary interrupters in the Y-element and by associated arc shunting resistors in the vertical elements on the T-bar.

Aluminum Production

(Continued from page 109)

is a decrease of 1,361 tons from the 148,391 tons produced in December, 1956. However, it is an increase of 6,636 tons over the amount for January, 1956. Total U. S. production of aluminum in 1956 was 1,679,247 tons. A record 3-month production in 1956 was the fourth quarter with 442,597 tons.

U. S. Copper Production

Primary copper production in United States in January totalled 94,944 tons, according to the Copper Institute, New York. This was 2,713 tons more than in December, 1956. Refined copper production was 139,150 tons for January, an increase of 9,311 tons over December, 1956. Deliveries to fabricators totalled 119,925 tons, up 20,331 tons from the preceding

month. Refined stocks at the end of January amounted to 118,564 ton, a decrease of 2,081 tons from the 1956 year end.

Line Material Industries, Thos. A. Edison Industries

Line Material Industries, McGraw-Edison Co, is the new title of the organization formerly known as Line Material Co, stated R. G. Wheaton, L-M president. "Industries", he said "is more descriptive of the broad field of L-M products and of its 10 plants". The title change comes out of the recent merger of McGraw Electric Co and Thomas A. Edison, Inc. L-M has been a division of McGraw Electric Co since 1949.

Another unit of the merger has a new title—Thomas A. Edison Industries, West Orange, N. J. This unit, reports a spokesman, retained the same operations and functions as a group as under the former name Thomas A. Edison, Inc.

M & M BRIEFS

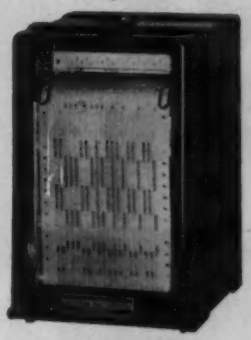
Joseph T. Ryerson & Son, Inc., warehousing subsidiary of Inland Steel Co, has entered into an agreement with Jasper Blackburn Corp, St. Louis, to lease the Blackburn property on North First St. This property will be used to expand the Ryerson operations in St. Louis.

Astoria Body Corp, Astoria, Ill., has been established to manufacture utility bodies for one-half and three-quarter ton trucks for marketing by Gordon Metals Products Co, Plymouth, Ind. Also produced are hotline trailer trucks which were developed jointly with Bodendieck Tool Co, Taylorville, Ill., and are sold by the tool company.

Sel-Rex Corp, Newark, N. J., is a company formed by the merger of Bart-Messing Corp and Sel-Rex Precious Metals Inc. Morris M. Messing is president. Rectifier, Precious Metals, and Chemical Divisions have been formed to manufacture and market products of the merged companies.

ARE THESE PROBLEMS BOTHERING YOU?

- Productive and idle time?
- Flow of materials?
- Position of gates and dampers?
- Time of failure in life tests?
- Length of phone calls?
- Sequence of switching?
- Timing of events?



The operation recorder will obtain the answers to these problems, and many more, for you. An instrument with 20 pens writing on a moving chart, the operation recorder shows:

- *When events occur*
- *How long they last*
- *How frequently they occur*
- *The relationship of a series of events to each other*

Product Representatives in Most Principal Cities

Write for Bulletin 247A, *"Operation Recorders—Their Selection and Use."*

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Pioneers in the Manufacture of Graphic Instruments

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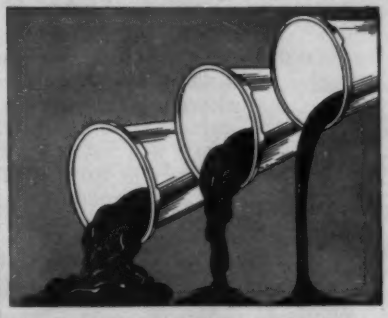
Are you missing something in Electrical World?

Right now, have a look at the complete, compact, 2-minute summary of the book, printed on special yellow stock at the front. Here is *the gist* of what's going on in the industry! "Newscope" covers future and late news; "Electrical Week" examines events, generation, distribution, commercial, management, people, manufacturing, and new equipment; "Engineering Trends" briefs *that* aspect of issue content. This specially written summary in the front of each issue, on yellow stock for easy finding, gives you *the complete overall picture of the industry and everything affecting it for the past week!* It mirrors the contents of each issue for absorption almost at a glance — let's you invest your Electrical World reading time more profitably.

Insulating and Cable-Pulling

COMPOUNDS

of Record-Breaking Performance



Minerallac gives you a complete assortment for every need: dense, viscous and fluid consistencies for high and low voltages in cable-joints, pot-heads, terminal bells, distribution cables, street lighting, telephone work. . . . Insoluble in oil or water, for all temperatures. Clean, safe, economical—outranks all others in quality.

Send for new literature and prices.

MINERALLAC ELECTRIC COMPANY

25 North Peoria Street—Chicago 7, Illinois

MINERALLAC

when a job is this hot...

It's 10:30 P.M. The new substation is behind schedule and your engineer is working late to meet the deadline. When it comes time to specify components, **delivery** will naturally be an important question. So Royal will be the logical choice to furnish the switchgear and connectors.

Royal's compact operation is purposely kept flexible—so each order gets custom service and **delivery when needed.** The "Royal treatment" is no idle phrase . . . it's a customer pledge we live by.

Whether your project is normal or rush, large or small, you'll like dealing with Royal—for switchgear, any one of 5,000 standard connectors, or a special design to be engineered. Save time—call Royal first!

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1122 EAST 87TH STREET • CHICAGO 19, ILLINOIS
Designers and Manufacturers of Power Switching Equipment and Special Electrical Devices

ELECTRICAL BUSINESS OUTLOOK

Electrical World
MARCH 4, 1957

January's 1.8 million drop in employment—the largest in any postwar year—and an unusually large increase in unemployment are worrying a lot of people. The figures will look even worse in February. Unemployment almost always rises between January and February, and employment usually stays at about the January level.

There were special reasons for the sharp sag this January. About ⅔ of the decline in employment showed up in the wholesale and retail trades and in government. We have just passed through the briskest Christmas selling season on record—one that was anticipated well in advance by both retailers and the Post Office. They took on abnormally large numbers of temporary employees last fall to get through the season. The employment drain-off in January was, consequently, especially large.

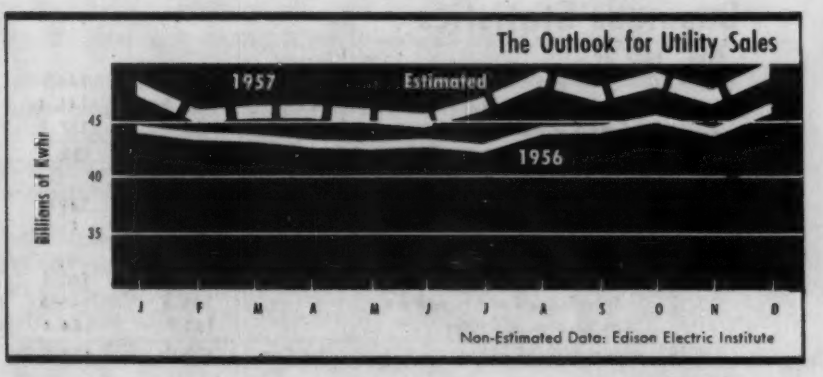
Wage and salary income, as a result, may show a slight decline in January. In the manufacturing sector where employment held fairly steady, production workers put in less overtime than in December and consequently sustained a drop in weekly take-home pay. This, on top of a drop in total employment in trade and government, may lower consumer income for early months of '57.

This is the trough of the year for employment. It normally picks up in March, and should rise steadily to a peak in August. The fact that total employment in January is 1 million above last January despite the December-to-January drop is some indication of the growth of the economy over the past year.

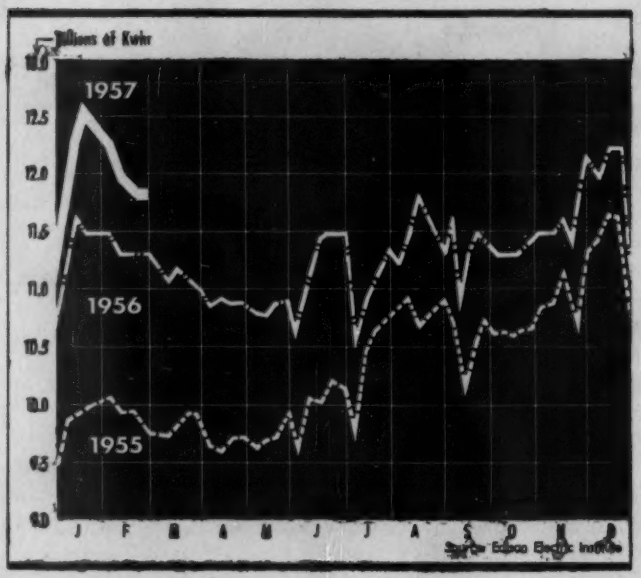
Unemployment on this scale won't effect utility sales much. But combined with the likelihood of consumer credit tightening and further drop in housing starts, the normal electric distribution valley may drop below estimates for this time of the year.

These bearish factors are reflected in December shipments of appliances. NEMA's index shows a drop of 16.8% from manufacturer's December 1955 shipments. The decline from '55 has been a monthly occurrence since last May (except July's 13.3% jump in anticipation of Christmas sales).

One healthy note in the cautious consumer credit outlook: Federal Reserve Board study says most of $40-billion-plus debt is concentrated in families earning from $3,000 to $7,500. Delinquencies for this typically young group are insignificant. Only ⅓ of families with income below $3,000 are using installment credit. Of these, more than half owed less than $200.



STATISTICS



OUTPUT

Week ended Feb. 23, 11,920,000,000 Kwhr Up 5.7%

Per Cent Change From Previous Year

	Feb. 9	Feb. 16	Feb. 23
Total U. S.	+ 6.0	+ 5.5	+ 5.7
New Eng.	+ 5.3	+ 5.9	+ 4.8
Mid. Atlan.	+ 4.7	+ 5.2	+ 3.3
Cent. Ind.	+ 5.8	+ 5.9	+ 6.0
West Cent.	+10.0	+ 7.5	+ 9.2
Southeast	+ 4.5	+ 6.7	+ 7.4
South Cent.	+13.3	+11.3	+10.8
Rocky Mount.	+ 6.1	+ 5.8	+ 8.5
Pacific			
NW	− 2.5	− 6.4	− 2.9
SW	+11.6	+ 5.0	+ 4.2

Seasonally Adjusted Index 228.2
Week Ago 226.7
Year Ago 216.1

Atomic Energy Commission requirements—1,150,000,000 Kwhr (Electrical World estimate). Excluding AEC, output increase was 6.1%.

Power Statistics . . .

		Latest Month	Preceding Month	Year Ago	Annual Change %
Capacity	Dec.	120.44	119.91	114.47	5.2
Peak—Class 1 Systems	Dec.	101.2	96.6	96.5	4 9
Estimated Dec. '56 Peak	Nov.	106.2	106.2	104.5	1 6
Estimated Dec. '57 Peak	Nov.	114.8	114.8	111 .6	2.9
Production—billion kwhr	Dec.	52.88	50.65	50.82	4.1
Hydro		10.00	9.31	9.34	7.1
Fuel		42.88	41.34	41.48	3.4
Sales—billion kwhr	Nov.	45.78	45.98	42.96	6.6
Residential		11.66	11.27	10.74	8.6
Commercial		7.20	7.37	6.61	8.9
Industrial		24.51	24.79	23.28	5.3
Other		2.41	2.56	2.33	3.4
Fuel Consumption	Dec.				
Coal—million tons		14.73	14.03	14.81	−0.5
Oil—million barrels		8.22	7.13	8.55	−3.9
Gas—million cu ft		82.17	88.73	69.85	17.6
Net Income Class A & B Co's—$ million	Nov.	102.54	95.79	102.79	−0.2
Residential Customers—millions	12 mos.	45.62	45.49	44.30	3.0
Revenue per kwhr	ended	2.60¢	2.60¢	2.65¢	−1.9
Avg kwhr per customer	Nov. 30	2,956	2,942	2,728	8.4
Avg annual bill		$76.86	$76.49	$72.29	6.3

Business Statistics . . .

Indexes: 1947–49 = 100					
FRB Industrial Production	Jan.	145	144	143	1.4
ENR Construction Cost	Feb.	148.9	148.4	142.6	4.4
BLS Cost-of-living	Dec.	118.0	117.8	114.7	2.9
New Orders for Machinery (1950 = 100)	Dec.	135	139	151	−10.6
NEMA Sales					
Insulation materials	Dec.	139	149	160	−13.1
Electric appliances		84	81	101	−16.8
Wholesale prices	Dec.				
Motors and generators		140.6	140.1	126.5	11.1
Transformers and regulators		146.6	146.6	131.2	11.7
Switchgear and fuses		163.9	164.4	147.5	11.1
GNP—annual rate—$ billion	3rd Qtr.	423.8	413.8	397.3	6.7

MANAGEMENT BULLETIN

FINANCE

Over $94 million in new securities were offered to the public last week, including the $55 million debenture issue of Consolidated Edison Co of New York (see p 19 for details). South Carolina Electric & Gas Co stockholders are being given the right to subscribe to 336,085 common shares on a 1-for-10 basis, record Feb. 26 to expire March 12 at $18.25 a share. Kidder, Peabody & Co group is the underwriter . . . Dillon, Read & Co and Johnston, Lemon & Co group is offering 300,000 shares of $2.44 $50 par preferred stock of Potomac Electric Power Co at $50 a share to yield 4.88%. Initial offering is "very good" . . . Kuhn Loeb & Co group wins $5 million Southern Indiana Gas & Electric Co first mtge 4⅜% bonds (Aa) due 1987 at 101.80%; reoffers at 102.623% to yield 4.22% . . . Carl M. Loeb Rhoades & Co bids 17.892¢ a share to underwrite an issue of 528,000 common shares of West Penn Electric Co. Commonholders are being given the right to subscribe for the stock on the basis of 1-for-16, record Feb. 26 to expire March 14 at $24.50 a share.

With interest rates continuing at high level, utilities turn to common stock financing. Even with the early February lull in security offerings, electric companies during this first quarter will put out more common than they did in all of last year. During the last half of the quarter electric utilities have scheduled offering of $174 million. Added to the $88 million sold in the first half of the quarter, the total will be $262 million compared with $246 million for all of 1956, a recent study by Irving Trust Co shows.

Rights offerings seem to be catching on in a big way. Ohio Edison Co shareholders oversubscribed an issue of 580,613 shares by 120,546 shares. Those sold at $46.50 a share. Some 96.5% of the total rights to subscribe were exercised, leaving 3.5% or 20,137 shares for allotment on over-subscriptions.

Of the seventeen common stock issues being offered by electric companies during the first quarter all but two will be rights offerings. Last year the electric companies sold some ⅔ of the dollar amount of their stocks directly to the public.

Here's a tip on scheduling information meetings prior to offering. Before you set a meeting date, consult with some of the larger investment firms specializing in utility securities or get in touch with John Childs, vice president, Irving Trust Co. They'll be glad to help you avoid conflicts with other utility informational meetings.

Stock split has been voted by directors of Virginia Electric & Power Co. If approved by shareholders at annual meeting April 17, the stock would be split on a 2-for-1 basis. The directors also approved a plan to sell additional common stock in June to raise about $22 million.

RATES

Baltimore Gas & Electric Co files new electric and gas schedules. Maryland Public Service Commission gets schedules which plans a $732,000 a year reduction in operating revenues. It will become effective in 30 days if approved.

South Carolina legislature receives bill which would have a special senate committee investigate rates charged by electric companies. The aim of bill would be to determine whether rates charged by the companies are "reasonable" and that operating expenses on which rates are based are "economical, necessary and in the public interest."

Southern California Edison files $34 million supplemental rate application with the California Public Utilities Commission. This is a $20 million increase from the original application of $13.5 million filed last September. The utility said it had these added $20 million costs since the first application: $4.5 million increased fuel costs; $3.5 million increased cost of operation and maintenance;

$3 million to service increased investment in plant, and $9.6 million increased costs of capital.

ACQUISITIONS

A $90 million cash offer for New York City's three subway power plants has been made by Consolidated Edison Co of New York. Transit Authority has recommended that offer be turned town. Offer, expiring April 1, made by Con Ed's Pres H. C. Forbes proposes ten annual payments of $9 million each. The offer would guarantee a low power rate for first 10 years of the agreement; provide for next 10 years a rate of 5% below that set by PSC for other electric railroads and give city a $3 million credit a year for the amortization period in consideration of company's use of plants.

Interstate Power Co plans to buy the Peoples Gas & Electric Division of the Kansas Power & Light Co for about $17 million. It consists of the electric and natural gas properties in Mason City, Iowa, and eight small near-by communities. There are about 30,000 electric and gas customers involved. An electric transmission line will be built soon to integrate the property with Interstate.

PUBLIC RELATIONS

"Uncle Wethbee" has become a newspaper columnist for Consolidated Edison Co of New York. He is writing a column in New York newspapers covering interesting facts and behind-the-scenes stories about Con Ed people. Previously "Unc" has been assisting Tex Antoine on Con Ed's tv weather show.

Potomac Edison Co uses "spot ads" in school papers to promote free enterprise. Statements are linked together with the general theme "As Long As it's Business-Managed, Electricity is in Good Hands." For copies, write, P. G. O'Connell, advertising manager, Potomac Ed, Hagerstown, Md.

An eight page illustrated "Historical Review" of Hartford Electric Light Co will be available soon. For copy write Douglas W. Miner, public relations department, 266 Pearl St, Hartford 15, Conn.

LEGISLATION

Texas legislature gets bill for new state Public Utilities Commission. Rep Richard C. Slack of Pecos introduces bill in the Texas legislature that will regulate rates on electric, natural gas, and telephone service. Under the measure the governor would name a three-member commission. State Railroad Commission now acts on appeals from disputes involving natural gas rates set by cities.

A resolution has been introduced in the Rhode Island Legislature which would create a special investigating committee to attempt to determine whether the present basis for the utility rate structure in the state "is in the public interest."

LABOR

"Improving Human Relations" is a booklet released by the National Association of Manufacturers. It covers action steps to develop better supervisor-employee relations in the plant. Write NAM, 2 East 48th St., New York 17; price 50¢.

Tacoma, Wash., Department of Public Utilities grants 12½¢ per hr wage increase, effective January 31.

ADVERTISING

Ad headlines you are now seeing. Electric Companies Advertising Program are using these in March: "What Will Atomic-Electric Power Plants Look Like?"; "Cost of Living . . . STEEP—Electricity . . . CHEAP"; and "Will You Clean House with a 'Magic Wand'?" . . . Northern States Power Co has a snappy ad to sell its area. It is entitled "Sam Sells People." It tells how NSP's Sam McGowan travels 30,000 miles a year selling the company's greatest asset . . . PEOPLE.

"Call the museum, Joe; I think we're uprating a real antique!"

Your General Electric Apparatus Service Shop can rebuild your old transformers like new. The shop can uprate your old transformers in both kva and voltage for about two-thirds the cost of new transformers . . . can also convert to self-protected type. And you get new-transformer warranties. Call your G-E Apparatus Service Shop or Sales Office. 431-56

Progress Is Our Most Important Product

GENERAL ELECTRIC

RWMA Reports Business at Record Level in 1956

Final figures reported by the Resistance Welder Manufacturers' Association, Philadelphia, Pa., indicate that both new orders and shipments were at a record level in 1956.

New business finished 21% ahead of 1955, and shipments were 39.5% ahead of a year ago. Both of these categories were represented in excess of $47 million.

During December, members of the Association shipped equipment valued at $3,820,000. This was the fifth month in the last six during which, at least, this amount of dollar shipment was attained.

A backlog of slightly in excess of $12 million is reported as 1957 begins.

"How to Insulate a Cable"

Okonite Co, Passaic, N. J., has compiled information in Bulletin 1106 to aid wire and cable users in choosing the right cable design for their needs. The 28-page booklet is entitled "How to Insulate a Cable". It explains in non-technical language the four most used methods employed by manufacturers for applying insulation to electrical conductors. Requests for a booklet should be addressed to the company, Department DPR.

EXPANSION NOTES

• Marking 50 years progress in scientific tree care, the "home that trees built" was opened recently by F. A. Bartlett Tree Expert Co. This new headquarters building with 17,000 sq ft of office space is located on a 1.2-acre plot in Stamford, Conn. The company serves shade tree owners from Maine to the Carolinas and west to Illinois.

• Doubling the size and output of the installation it replaces, a $2 million plant was opened recently by Bridgeport Thermostat Division of Robertshaw-Fulton Controls Co. In this 180,000-sq ft plant, on a 15-acre site in Milford, Conn., there will be produced precision instruments, temperature controls for home appliances, metallic bellows, and instruments employing bellows.

Seal oil IN! Seal moisture OUT!

with

J-M TRANOLSEAL

developed especially for efficient sealing against refined oils

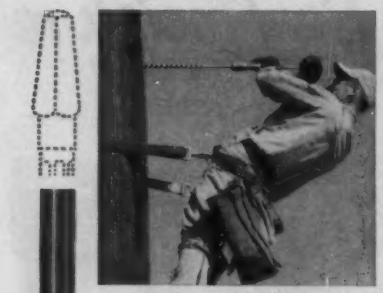
You can stop the dangerous and costly leakage of oil from transformers and switchgear with Johns-Manville's Tranolseal sealing compound. This permanently plastic material has a nondrying vegetable oil base. It provides effective sealing action against air (dust and moisture), inert gas, water, 13% NaCl brine as well as medium to high viscosity refined oils. Thus you can also prevent penetration by moisture and other ambient sources of trouble.

Tranolseal has excellent adhesive qualities and will not corrode or deteriorate metals, rubber or plastics. It shows good resistance to weather and aging (both painted and natural) and won't stain. Furnished in 1" diameter beads. For further information write Johns-Manville, Box 14, New York 16, N. Y. In Canada, Port Credit (Toronto), Ontario.

Johns-Manville SEALING COMPOUNDS

New adapter shank bit

fits either hand brace or power drill



Taper square shank fits hand braces

Cut off taper and use "hex" shank in both power drills and hand braces

Cut your wood bit inventory by 50%

Now you can eliminate the need to stock two types of wood auger bits. Irwin's new Adapter Shank Bit fits both hand braces and power drills.

With hand braces, use the Adapter Shank Bit as it comes. Cut off taper square and the Adapter Shank, with its 6 "hex flats", chucks perfectly in power drills or hand braces, either one. No wobble, no run-out. Clean, efficient cutting action. Reduces inventory and record keeping by 50%. Saves time on the job, too. Call your distributor, or write today for complete information. Sizes 4/16" to 17/16", both solid center and single twist types.

***All Irwin Adapter Shank Wood Bits** are forged in one piece from special steel and heat tempered full length for longer life. Plastic coating on balanced cutting heads guarantees factory-fresh sharpness, unequalled performance. Widely used by utilities, electricians and construction workers.*

IRWIN auger bits • screw drivers

Wilmington, Ohio

READERS FORUM

Favors Higher Rates

To the Editor:

Congratulations on the article which appeared in the issue of Dec. 3, 1956 (page 16) titled "Street Lighting Can Pay Its Way," by William S. Leffler, Noroton, Conn.

I concur, and have concurred for a long time, in the principles involved respecting this subject, not only in basic costing to the end that street lighting studies should show the full measure of allocable costs to that class of service but, more importantly, that costing, pricing, and resultant rate schedules should be fully realistic with respect to the actual class of service effects.

Notwithstanding my personal desires for realism, we have a problem here in the West. The private utilities have been subsidizing street lighting from the early 1900's, basically as a means of forestalling municipalities from going into the electric business. Thus, they were, at that time, more concerned with rates for street lighting service than with rates for other classes of service.

In the early days, the regulatory bodies were not so concerned with subsidy rates as they are present day. Nevertheless, not so long ago, one public utility in the West indicated that its costs for street lighting warranted a 36% increase in rates. However, in their application to the Public Utilities Commission, they requested an increase of approximately 22%, but the Commission granted them approximately only about one-half of the request, namely, about an 11% increase. Thus, street lighting rates are still being subsidized at the expense of other classes of customers. The resultant effect on municipal electric utilities is, therefore, that they have been, and are, faced with a problem of remaining competitive regardless of costs, or of being faced with public criticism if its street lighting services were rendered at rates based on costs where such rates were evidently higher than those in effect by private utilities in adjacent areas.

Again, congratulations to the Electrical World and to the author of the article on a very nice presentation, which is not only timely in these days of rising utility costs, but interesting, not only to those of us in the business, but perhaps to those customers who are carrying the effects of the subsidies.

H. M. Langlois
Los Angeles, Calif.

Format Is Popular

To the Editor:

Three cheers for the new Electrical World! You have made an already good magazine better. I like the layout best of any magazine on the market today. I read the yellow pages first as in them a world of information is readily and quickly available. Then after much deliberation as to what to read next, I begin the delightful chore of reading from cover to cover the items in which I am most interested. "The How To" section rates high in my book. It is hard to find any section that doesn't hold my interest. Keep up the good work.

Monroe Pope
Florida Power & Light Co
120 SW 53 Court
Miami, Fla.

To the Editor:

I would like to compliment you on the new format for your magazine. I believe that it is a great improvement and makes the reading of Electrical World more enjoyable.

James W. Taylor, Partner
Booz, Allen & Hamilton
380 Madison Avenue
New York 17, N. Y.

To the Editor:

I should like to express my approval of your new format. The combination of larger type size, increased size, elimination of the every-other-week feature, etc, combine to produce a magazine of excellent readability and worthwhile contests.

Richard A. Bellin
25 Del Balso Blvd
Wappingers Falls, N. Y.

Now *ONE* portable tool makes transmission line splices

OVERHEAD

It's no longer necessary for linemen to do the sagging and marking overhead and then lower the line to the ground for splicing. Now the complete operation, including splicing, can be performed overhead.

T&B's Forty-Ton Hydraulic Head has been specially designed for heavy-duty service in building transmission lines. Since it weighs only 36 pounds, this factory-rigged tool can be put into operation anywhere a man can throw a rope. Safety chains keep all removable parts from falling to the ground.

T&B's Forty-Ton Hydraulic Head, Cat. No. 21940, specially designed for transmission line building.

or ON THE GROUND

Demountable legs hold T&B's Forty-Ton Hydraulic Head at convenient working height when installations are being made on the ground. During operation, hardened steel dies compress fitting and cable hexagonally into one homogeneous mass . . . all in a few seconds. The same die set installs tension splicers, dead ends, loop splicers and taps, tees and terminals.

Modern hydraulic design has virtually eliminated the need for maintenance. However, field maintenance is simple and practical. The 21940 Installing Head can be completely disassembled and reassembled in less than one-half hour with these common tools: screw driver, Allen wrench, and mallet.

T&B Bulletin 70 gives a detailed description of the Forty-Ton Hydraulic Head as well as complete lines of T&B connectors, tools, and accessories for transmission line building. Send for FREE copy.

LOOK FOR THIS SIGN —

AUTHORIZED DISTRIBUTOR T&B ENGINEERED

IT'S THE MARK OF AN AUTHORIZED T & B DISTRIBUTOR

The complete line of T&B fittings for conductors and raceways is sold only by recognized electrical wholesalers. It's our way of assuring you the service and savings of a friendly local source. Call him for all your electrical needs. T-418

THE THOMAS & BETTS CO.

INCORPORATED

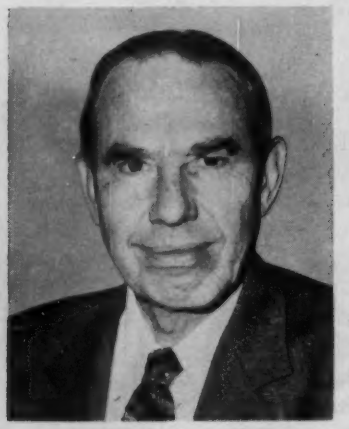
14 Butler Street • Elizabeth 1, New Jersey

Thomas & Betts Ltd., Montreal, P.Q., Canada

MANUFACTURERS OF FINE ELECTRICAL FITTINGS SINCE 1898

NEWS ABOUT PEOPLE

HALL M. HENRY



HARDING U. GREENE

HAROLD W. ATKINSON

NEGEA System Ups Henry, Greene, Atkinson

New England Gas & Electric Association has announced the elections of Hall M. Henry as president and Harding U. Greene as vice president of NEGEA Service Corp. In addition, Harold W. Atkinson becomes general manager of Cambridge Electric Light Co, a NEGEA subsidiary.

Henry, who succeeds the late Ralph D. Stauffer, has been with the NEGEA system since 1938, when he was named assistant to the president of the system. He subsequently rose to vice president of the service corporation and director of system gas operations. He is currently vice president of gas subsidiaries in Cambridge and Worcester.

Greene, in addition to his new post, will continue as vice president of the Cambridge utility, a position he has held since 1939. His career began with J. G. White Management Corp in 1920, soon after he obtained his EE degree from Columbia University. In 1923 he went to Cape & Vineyard Electric Co and later became its general manager. He was transfered to Cambridge in 1927 where he became general manager.

At the present time he is a member of the technical liaison committee of the Yankee Atomic Electric Co. This latter company was formed by approximately 12 New England electric utilities to develop nuclear power production.

Atkinson moves to his new post after serving as assistant general manager since 1953. He joined the company as power sales engineer in 1935, the year he received his M.S. degree from Harvard Business School. He joined a rural co-operative in South Carolina in 1939, and after serving in World War II, he returned to the power sales engineering staff at Cambridge in 1946. He became assistant to the general manager in 1949.

Reed, Brookover Are Elevated

O. P. REED

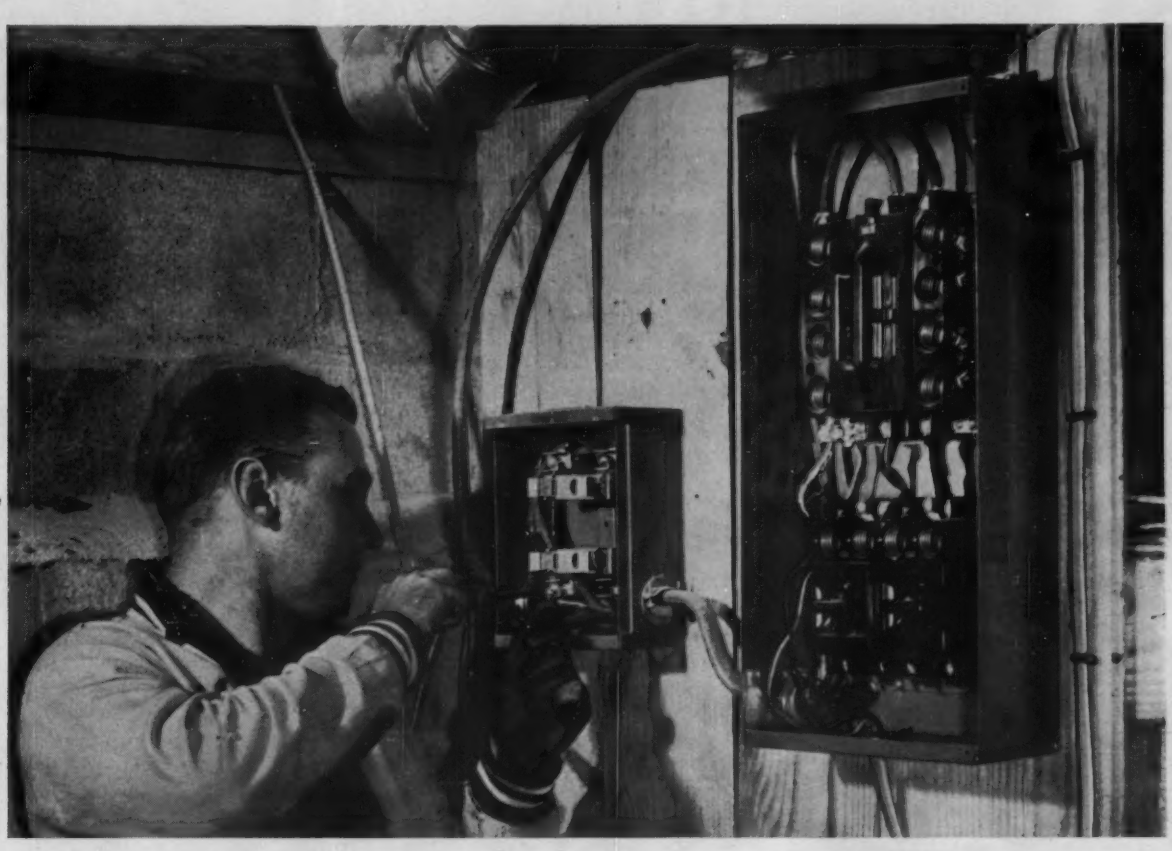
PAUL E. BROOKOVER

O. P. Reed, vice president and general manager of Cheyenne (Wyo.) Light, Fuel & Power Co, has been appointed manager of employee relations for Public Service Co of Colorado. The Cheyenne firm is a PSC subsidiary.

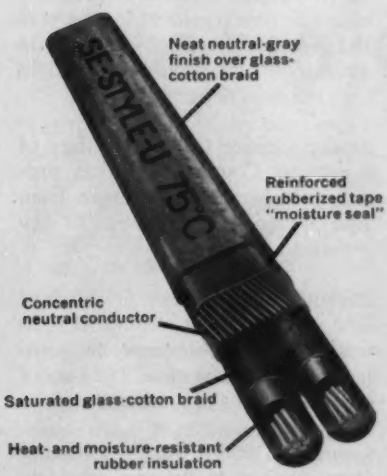
Succeeding Reed is Paul E. Brookover, previously division commercial superintendent for PSC.

Reed, who has served as vice president and general manager since 1931, will take over the employee relations duties formerly held by the late F. L. Witsell. He has been with the utility since 1919 when he started as a junior engineer in the firm's training program. He held successively more responsible jobs until he was promoted to district superintendent of electric, gas, and steam heat service at Cheyenne in 1931.

Brookover began his employment with PSC immediately after gaining his mechanical engineering degree from Kansas State College in 1931. Besides being manager of two of PSC's divisions, he has held supervisory and administrative posts in the company's engineering and commercial operations.



Rome's new service entrance cable is designed for modern 100 ampere service


Neat neutral-gray finish over glass-cotton braid
Reinforced rubberized tape "moisture seal"
Concentric neutral conductor
Saturated glass-cotton braid
Heat- and moisture-resistant rubber insulation
SE-STYLE U 75°C

Rome's new and improved Type SE service entrance cable meets all requirements for 100 ampere service that can handle all the electric appliances and air conditioning needs of modern living.

In addition, it may enable you to reduce warehouse inventory levels and the amount of cable carried in your service trucks. You can use the same cable: 1. From pole to meter. 2. From service drop to meter. 3. And from meter to electric range, clothes drier, hot water heater, etc.

Other features include:

1. The outer glass-cotton braid is finished to give the cable a neat appearance without sacrificing flame and moisture resistance.
2. The glass-cotton braid on each conductor—one red and one black—provides easy conductor identification.
3. Underwriters' approved for 75° C. operation in *either dry* or *wet* locations. A reinforced rubberized tape under the weather-resistant outer braid puts the conductors in a "dry location."
4. In three conductor construction for 100 ampere service, Underwriters' approval makes possible the use of size 3 AWG copper conductors, or two 3 AWG conductors with a 5 AWG neutral conductor.

Specify Rome service entrance cable for your next job. Contact your nearest Rome Cable representative for more information—or write to Department 365-B and ask for Bulletin SE-1. Rome Cable Corporation, Rome, New York.

ROME CABLE

CORPORATION

Brennan Becomes President

JOHN W. BRENNAN

John W. Brennan is new president of American Blower Corp, a division of American Radiator & Standard Sanitary Corp. He succeeds John D. Linsenmeyer, former president of AB and Ross Heat Exchanger Divisions, who is now executive vice president—operations of AR&SS.

Brennan has served as American Blower vice president of engineering since late in 1953. A graduate of Notre Dame University, he started with American Blower in 1927. After serving as a sales engineer in the Buffalo branch he rose to San Antonio branch manager in 1930 and in 1932 transferred to St. Louis in a similar post.

His 1934 appointment as manager of the Detroit sales office's industrial department was followed by his 1945 promotion to manager, Hydraulic Coupling Division. He became AB's chief engineer in 1951.

WALTER W. SLOCUM

Slocum Named Executive VP

Walter W. Slocum has been elected executive vice president of Weston Electrical Instrument Corp, a subsidiary of Daystrom, Inc. He previously served as Daystrom's vice president of operations.

Slocum, a former president of Daystrom Instrument Division, has been a member of Weston's board of directors since 1955. Before joining the Daystrom organization, he was president of W. W. Slocum & Co, industrial engineers, and held general management posts with Day & Zimmerman and the J. G. White Engineering Corp.

In other company promotions, Russell A. Schlegel was advanced from sales manager, industrial sales division, to general sales manager, and John Hemion was named assistant to the general sales manager.

PERSONAL BRIEFS

W. D. Nuckols, former Central Division engineer, has been named electric operations engineer on the general office engineering staff of Community Public Service Co.

D. P. Newman has been named district engineer of Appalachian Electric Power Co's Charleston district to succeed **J. F. Milton,** who has advanced to district superintendent.

Atomic Energy Commission has transferred **Francis R. Dowling** to its Washington headquarters as chief of the feed materials branch of the Production Division.

Boston Edison Co's engineering and construction department has named **Albert J. McCahan** head of the testing and standards section. **James T. Henry** has been appointed head of the Planning and Analyzer Division of the same department.

Sangamo Electric Co has appointed **T. N. Teigen** manager of the advertising department to replace **J. H. Williams,** who has resigned from his position as general advertising manager.

Reginald L. Johnson is new vice president of Johns-Manville Sales Corp. In his new post he will have charge of all company advertising and sales promotion activities as sales promotion manager, succeeding **H. M. Shackelford,** who has retired.

Allis-Chalmers Manufacturing Co has appointed **H. D. Emmert, Jr,** as chief engineer of its steam turbine department to succeed **H. S. Bimpson,** retired . . . A-C's new nuclear pump section at West Allis centrifugal pump department has named **Arthur F. Erwin** engineer-in-charge.

Intermountain Electric Association has as its new president for the year **DeLamar Holt,** residential and farm director of Utah Power & Light Co's business department.

Braden Copper Co, a subsidiary of Kennecott Copper Corp, has promoted **Robert M. Haldeman** from general manager to the office of vice president.

Recently elected a vice president of Robertshaw-Fulton Controls Co was **John A. Robertshaw, Jr,** assistant vice president since 1954 and a grandson of one of the founders.

George W. Smith, Jr, has advanced from assistant to the vice president of sales for S. Morgan Smith Co to operations manager, turbine Division.

(More Briefs on page 125)

SQUEEZED like an accordion even to the point of edge rupture . . . yet, there is no opening of the welded seam.

FLARED while cold during a cone test. Note the weld. There's not a single indication of a break.

FLATTENED like a pancake—actually creased along the weld. But, look at the weld—still unbroken, and as good as ever.

EXPANDED 25% and flared. If weld flaws existed, this test would find them. But look at it—still strong as ever.

Four-way "torture" tests fail to break the weld on Rome's improved EMT

The purpose of these tests was to prove the strength of a Rome weld. But you can see by the unretouched photographs above that the weld on Rome's EMT just won't break.

In these punishing factory tests, Rome's EMT was squeezed, flared, flattened, and expanded. In each case, the weld was proved to be as strong as the metal itself.

And Rome's EMT offers you much more in addition to high weld strength. You also get these *other* important benefits:

Easy bending. Its strength interferes in no way with Rome EMT's uniform ductility. You can now make even intricate bends easily.

Outstanding fishability. The new slick mirror-smooth inside finish makes Rome's EMT easier and quicker to fish than *any other EMT* you can buy. This means you can wire up your installations much faster.

Corrosion resistance. A uniformly electrogalvanized exterior finish protects your installation against corrosion. Long dependable service life is assured.

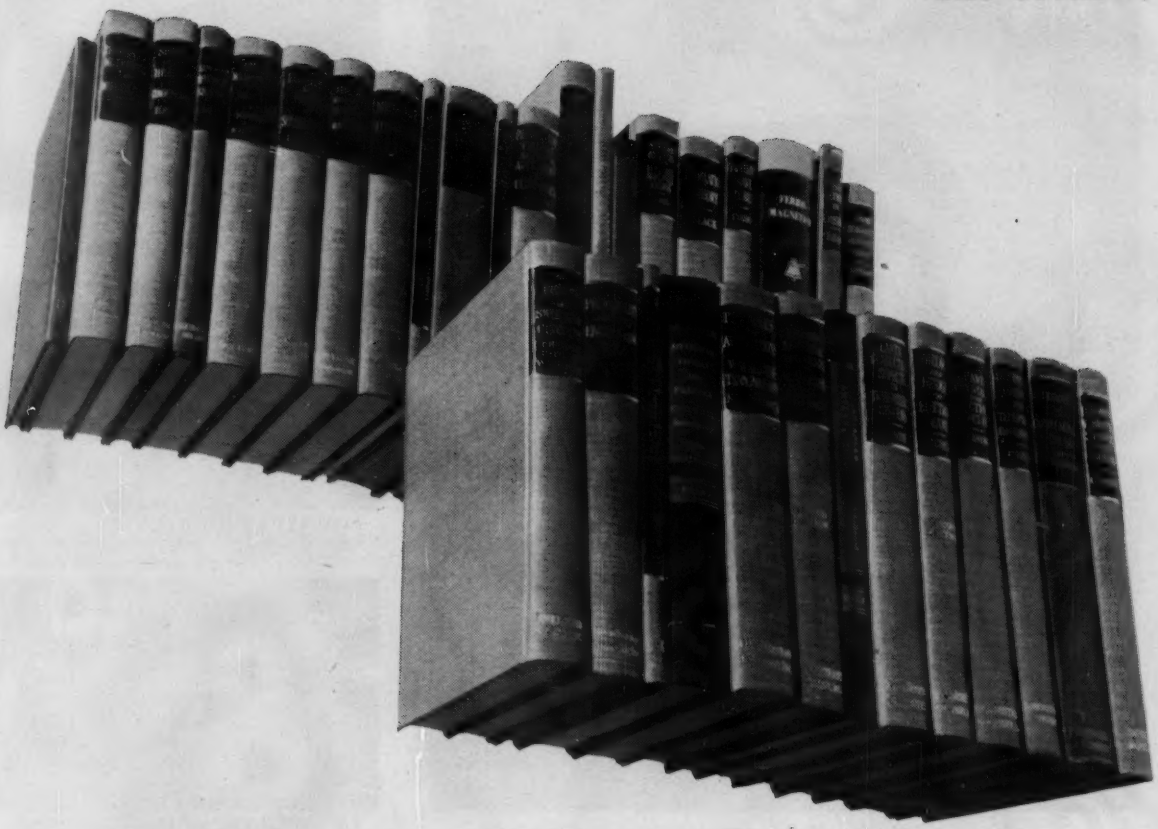
This exceptionally durable and sturdy tubing exceeds all standards for thinwall raceways and has full Underwriters' approval.

A free sample of Rome's EMT is yours upon request. Test it and prove to yourself that Rome is your best choice for your next EMT job. Contact your nearest Rome Cable representative—or write to Department 900-B, Rome Cable Corporation, Rome, New York.

ROME CABLE

CORPORATION

The books...



How the scientific world shares in fruits of the telephone art

In their work to improve telephony the scientists and engineers of Bell Telephone Laboratories make important findings in many sciences. They thoroughly report these findings in professional journals and magazines. But sometimes, as knowledge accumulates in a vital field, a "treatment in depth" is prepared in book form.

Bell Laboratories authors have written 36 books to date and others are in preparation. Many have become classics in the Laboratories' primary field of communications. Many have become standard works of wide application because they provide a fundamental guide for technologies in other fields. For example, the design of automatic switching systems is of primary importance in computers; statistical quality control provides the indispensable basis for economical manufacture. Through their books these scientists and engineers and the Laboratories attempt to repay benefits they receive from the published works of others.

The pictures on the opposite page show some Bell Laboratories authors of technical books. A complete listing of titles may be obtained by sending in this coupon.

Publication Department, Dept. 17
BELL TELEPHONE LABORATORIES
463 West Street, New York 14, N. Y.

Gentlemen:

Please send me a listing of titles, authors and publishers of books written by Bell Telephone Laboratories authors.

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Street.....

City.....State.....

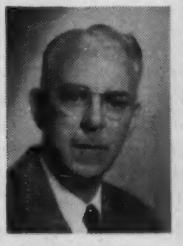
BELL TELEPHONE LABORATORIES

World center of communications research and development

(advertisement)

...the authors

Most of the books written by Laboratories authors are published by D. Van Nostrand Company. Other publishers include John Wiley & Sons and McGraw-Hill. Subjects include speech and hearing, mathematics, transmission and switching circuits, networks and wave filters, quality control, transducers, servomechanisms, quartz crystals, capacitors, visible speech, earth conduction, radar, electron beams, microwaves, waveguides, antennas, traveling-wave tubes, semiconductors, ferromagnetism.



Harold S. Black, B.S. in E.E., Worcester Polytechnic Inst., author of "Modulation Theory."

John R. Pierce, Ph.D., California Inst. of Tech., author of "Traveling-Wave Tubes."

Richard M. Bozorth, Ph.D., California Inst. of Tech., author of "Ferromagnetism."

W. Thornton Read, M.S., Brown University, author of "Dislocations in Crystals."

Hendrik W. Bode, Ph.D., Columbia University, author of "Network Analysis and Feedback Amplifier Design."

Walter A. Shewhart, Ph.D., University of California, author of "Economic Control of Quality of Manufactured Product."

(Continued from page 122)

Harza Engineering Co has designated **E. Pierpont Graham** an associate. Graham, a specialist on hydroelectric plant electrical design, will continue as head of the electrical department.

George W. Hartwell has been named chief engineer of Worthington Corp's commercial refrigeration equipment component and **Henri Soumerai** is new chief engineer of refrigeration compressor development, Air Conditioning & Refrigeration Division.

New director of research of Union Carbide Nuclear Co, a division of Union Carbide & Carbon Corp, is **Dr Frank W. Hurd,** former superintendent of research and development, industrial applications . . . US&CC has advanced **H. T. Ross** to vice president-engineering of its Linde Air Products Co division.

Harold R. Kohl was recently named manager-manufacturing engineering for General Electric Co's foundry department, Erie Foundries . . . New market development manager for GE's communication products department is **Kent J. Worthen,** former district sales manager, mobile communications equipment at Los Angeles . . . GE's service shops department has as its new manager of marketing research and product planning **Lee J. Mohler.**

Paul F. Ewing has been named northwest public relations manager by Kaiser Aluminum & Chemical Corp. He is former regional information director for the Department of Interior in Portland (Ore.).

Pittsburgh Reflector Co recently designated **Myles R. Lees** production control manager.

James S. Hagan has been named division manager of Westinghouse Electric Corp's new Sunnyvale (Calif.) Manufacturing Division. The division, recently elevated from plant status, has as its division engineering manager **George F. Gayer.** In addition, **Joseph H. Cox** has been named engineering manager, electrical products, and **George H. Heiser** becomes engineering manager, mechanical products.

New sales manager of Buffalo Forge Co's Blower and Air Conditioning Division is **Charles W. Lockhart** . . . **Herbert T. Brunn** has been elected vice president-administration, RCA International Division, Radio Corp of America.

The appointment of **Robert H. Caughey** as chief metallurgist has been announced by M. W. Kellogg Co, a subsidiary of Pullman, Inc.

General Motors Corp has announced the following promotions on its research staff: **John M. Campbell** has been named to the new post of scientific director; **Arthur F. Underwood** becomes manager of staff activities; and **Gregory Flynn, Jr,** succeeds Underwood as head of the mechanical development department.

M. J. Wurzbach has been designated staff director-product information of United States Steel Corp's public relations department.

Curtis D. Cummings is new sales manager of American Chain & Cable Co's Campbell Machine Division.

Newly appointed vice president and general manager of Pacific Coast Engineering Co is **C. Dean Ramsden.**

J. L. Reid becomes supervisor of hydroelectric development in the provincial department of Agriculture's Water Resources Branch, Alberta, Canada.

OBITUARY

David E. Harris, 77, former vice president of General Electric Supply Co, died recently. Until his retirement 10 years ago, he was with GE Supply or a predecessor for over 50 years.

William E. Wood, 69, a former president of Virginia Electric & Power Co, died recently of a heart attack.

David O. Rhea, 42, purchasing agent for Commonwealth Edison Co died recently.

TO BUILD YOUR LIGHTING BUSINESS . . .

Enter The 1957 International

Stories on top winning entries will be published in ELECTRICAL WORLD

Local publicity will stimulate lighting business!

$5,400.00 in cash prizes will be awarded!

Have you completed an outstanding lighting job since January 1st, 1956? Do you have one planned—or working—to be finished before October 25th, 1957? Why not let that job bring you extra profit . . . and industry-wide recognition? Enter it in the 1957 International Lighting Competition!

The competition is open to any individual who is either the owner or manager, or an employee of any of the following types of business, provided he complies with all the requirements outlined in the official rules of the competition: 1. Electrical Contractor. 2. Electrical Wholesale Distributor. 3. Architect or Engineer. 4. Electrical Utility.

The contest opens March 15th, and closes October 25th. Announcement of award winners will be made during the week of November 11, 1957.

The competition is sponsored by three McGraw-Hill publications: Electrical World . . . Electrical Construction and Maintenance . . . Electrical Wholesaling . . . with the cooperation of the National Lighting Bureau (National Electrical Manufacturers Association).

Commercial, industrial and institutional lighting installations winning cash prizes will be certified by the National Lighting Bureau, NEMA, providing the installation plans meet certification standards. Certificates will be presented to all cash prize winners, and honorable mention winners. In case of tie, duplicate awards will be made. Wherever practical, awards will be made locally; if possible at electrical group meetings.

Send in the coupon below for detailed information on the 1957 International Lighting Competition. Make your outstanding lighting job pay off in extra cash, and valuable public acclaim!

LIGHTING CLASSIFICATIONS:

Lighting installations are divided into six separate and individual groups. Separate awards will be made for each classification, within each contestant division. The installation classifications are:

1. **Industrial**
2. **Store**
3. **Office**
4. **Institutional**
5. **Outdoor Lighting**
6. **Residential Lighting**

PRIZE AWARDS:

The 120 cash prizes offered, total $5,400.00. There are five prizes for each of the six installation classifications, and these prizes are offered within each of the four contestant divisions. The prize awards for each classification and within each division:

First Prize: $100

Second Prize: $50

Three Prizes: $25 each.

JUDGING:

Competent and fair consideration for each entry has been assured through appointment of nine individuals, each a well-known authority in the field of illumination, to serve as judges. These individuals will form three panels of three members each, to judge the separate lighting classification groups. The decisions of the board with respect to awards and all other competition matters are final and binding on each participant. The competition and awards are subject to all applicable local, state and federal laws and regulations.

Lighting Competition!

OFFICIAL COMPETITION RULES:

RULE 1 — Application to enter the Competition must be made in writing. Applicant may use an Official Entry Application form, which will be supplied by the Lighting Competition chairman upon request. (In any case where the applicant is unable to obtain an Official Entry Application form, he may send in his request to enter by letter).

RULE 2 — Any individual—who may be the owner or manager, or an employee of any of the following types of business — may enter the contest. These types of businesses, which are to be known as Contestant Divisions, are: electrical contractor; electrical wholesale distributor; architect or engineer; and electric utility. Either individual or joint entries may be made; joint entrants must specify which Contestant Division they are entering.

RULE 3 — Entries must be made in one of the following Installation Classifications: industrial lighting; store lighting; office lighting; institutional lighting; outdoor lighting; residential lighting.

RULE 4 — Contestants or their firms must have been responsible for either the design, layout, sale or installation of the lighting installation covered by each entry. The contestant will state this eligibility by describing in detail in each entry the part he took in the design, layout, sale or installation. In the case of joint entries, each contestant must state in the entry the work for which he was responsible.

RULE 5 — A contestant may submit any number of entries.

RULE 6 — Each entry must cover one or more of the following:

a. A lighting installation for a single specific visual requirement.

b. A lighting installation for a specific area, large or small.

c. An overall lighting installation for an entire building, project or general area.

A lighting installation using any make, or brand, or type of electric lighting equipment, and based on any lighting system design or layout, regardless of whether such lighting equipment, lighting system design or layout conforms with recognized standards for good lighting practice, may be enter 1 in the Competition. The Board of Judges, however, will judge all entries based on those factors conforming with recognized standards of good lighting practice.

RULE 7 — Each entry must be submitted separately, in an official Competition Entry folder bearing an official Registration Number as assigned by the Competition chairman.

RULE 8 — All entries, to be eligible in the Competition:

a. Must be mailed on or before the closing date of the Competition (October 25, 1957), and must be received by the Competition chairman on or before November 4, 1957.

b. Must cover lighting installations completed within the period between January 1, 1956 and October 25, 1957.

RULE 9 — In submitting an entry, the contestant agrees to be bound by all rules of the Competition, and to abide by the decision of the Board of Judges, which will be final. All entries become the property of the sponsors of the 1957 International Lighting Competition, and no entry will be returned. All entrants, by submitting entries, further agree to grant the sponsors full reproduction and publication rights.

MAIL THIS COUPON FOR RULES AND ENTRY FORMS:

Berlon C. Cooper, Chairman
1957 International Lighting Competition
330 West 42nd Street
New York 36, N. Y.

Please send me the rules brochure and _____ entry forms for the 1957 International Lighting Competition.

Name _____

Company _____

Address _____

City _____ Zone _____ State _____

EMPLOYMENT OPPORTUNITIES

The Advertisements in this section include all employment opportunities—executive, management, technical, selling, office, skilled, manual, etc.

Positions Vacant | Civil Service Opportunities | Employment Agencies
Positions Wanted | Selling Opportunities Wanted | Employment Services
Part Time Work | Selling Opportunities Offered | Labor Bureaus

DISPLAYED RATES UNDISPLAYED

The advertising rate is $19.15 per inch for all advertising appearing on other than a contract basis. Contract rates quoted on request.

An advertising inch is measured ⅞" vertically on a column—3 columns—30 inches to a page.

Subject to Agency Commission.

$1.50 per line, minimum 3 lines. To figure advance payment count 5 average words as a line.

Box Numbers—counts as 1 line.

Discount of 10% if full payment is made in advance for 4 consecutive insertions.

Not subject to Agency Commission.

Send NEW ADS to Classified Advertising Div. ELECTRICAL WORLD, P. O. Box 12, N. Y. 36, N. Y.

SALES ENGINEERING Position in PROCESS CONTROL Instrumentation

Are you interested in a sales engineering career in the field of instrumentation and automation? We are looking for qualified engineering graduates, preferably chemical or electrical, between 25 and 35 years of age, with a few years' experience in instrumentation or engineering sales, for location in Boston area, Buffalo; Syracuse; Pensacola; Atlanta; Chicago; Tulsa; Houston; Baton Rouge; and Los Angeles.

Applicants must be willing to relocate and travel adjacent territory. Car furnished, salary and expenses, fringe benefits. Sales aptitude test furnished at our expense, plus thorough training course at home office (Foxboro, Mass.) for successful applicants.

If you feel you are qualified for a permanent sales engineering position in this expanding industry, please write to:

J. J. Burnett
Field Sales Manager

THE FOXBORO COMPANY
4546 OAKTON ST.,
SKOKIE, ILLINOIS

FOXBORO
REG. U. S. PAT. OFF.

ELECTRICAL ENGINEER

Electrical Engineer interested in electrical design of power plants or industrial plants. Experience not required.

Excellent opportunity with consulting engineering firm in Middle West. Liberal benefit plans and good working conditions.

Send resume of education and experience with statement of salary requirements to:

P-3234, Electrical World,
520 N. Michigan Ave., Chicago 11, Ill.

ELECTRICAL DESIGNERS

Conduit and physical layout men. Control and wiring exp. desirable but not necessary Work in air conditioned offices of a leading hydroelectric consultant in Chicago. Good starting salaries and liberal fringe benefits. Challenging work and opportunity for advancement. Please send complete resume to Hugo Niemi, Personnel Manager

HARZA ENGINEERING CO.
400 West Madison Street Chicago 6, Ill.

San Francisco City and County
Immediate Employment Possibilities
VARIETY OF PUBLIC WORKS PROGRAMS

Junior Engineer (Electrical) $460—$530
Assistant Engineer I (Electrical) $500—$600

For Further Information and applications, inquire:

San Francisco Civil Service Commission
154 City Hall
San Francisco, California

REPLIES (Box No.): Address to office nearest you c/o This publication Classified Adv. Div.
NEW YORK: P. O. Box 12 (36)
CHICAGO: 520 N. Michigan Ave. (11)
SAN FRANCISCO: 68 Post St. (4)

POSITION WANTED

Meter Supt. must relocate due to family health conditions. Specialized training and experience, in a first rate utility, in the testing and servicing of all types of metering equipment, modern relaying equipment, high-voltage circuit breakers, and central station apparatus. Desire a responsible position with a chance to demonstrate technical, organizational, and administrative ability and capability. References. PW-4210. Electrical World.

WANTED—ELECTRICAL ENGINEER

Electrical Engineer for power distribution engineering position with progressive public utility. Three-Five years experience in utility distribution engineering required. Excellent opportunity for qualified man. Salary open. Location: Massachusetts. Send resume including salary requirements.

P-4107, Electrical World,
Class. Adv. Div., P. O. Box 12, N. Y. 36, N. Y.

What Is *Your* Problem?

Do you need competent men — men experienced in the industry served by this publication? Men to fill executive, sales or technical positions? OR —are you seeking employment in any of these capacities?

The 25,000 other subscribers of ELECTRICAL WORLD are the logical ones to contact for a solution to your problem. They are identified with the same industry and speak your "language." You can get their attention — at small cost — through an advertisement here.

Write

CLASSIFIED ADVERTISING DIVISION
ELECTRICAL WORLD
330 W. 42 ST.
NEW YORK 36, N. Y.

CLASSIFIED SEARCHLIGHT SECTION ADVERTISING

BUSINESS OPPORTUNITIES — EQUIPMENT - USED or RESALE

UNDISPLAYED RATE:

$1.50 a line, minimum 3 lines. To figure advance payment count 5 average words as a line.

PROPOSALS, $1.50 a line an insertion.

BOX NUMBERS count as one line additional in undisplayed ads.

DISCOUNT of 10% if full payment is made in advance for four consecutive insertions of undisplayed ads (not including proposals).

DISPLAYED RATE:

The advertising rate is $14.00 per inch for all advertising appearing on other than a contract basis. Contract rates quoted on request.

AN ADVERTISING INCH is measured ⅞ inch vertically on one column, 3 columns—30 inches—to a page.

EQUIPMENT WANTED or FOR SALE ADVERTISEMENTS acceptable only in Displayed Style.

SEND NEW ADVERTISEMENTS TO Classified Advertising Div. of ELECTRICAL WORLD, P. O. Box 12, N. Y. 36, N. Y.

FOR RATES OR INFORMATION About Classified Advertising

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Office Nearest You.

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HUbbard 2-7160
H. J. SWEGER

CHICAGO, 11
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MOhawk 4-5800
W. HIGGENS
J. BRENNAN

CINCINNATI, 37
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Swifton Village, Apt. 2
G. MILLER

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SUperior 1-7000
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Adolphus Tower Bldg.,
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LOngacre 4-3000
S. HENRY
D. COSTER
R. LAWLESS

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RIttenhouse 6-0670
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W. HIGGENS

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3—1000 KVA Mol 11500-2400/4160Y
3—1000 KVA Mol 13200-2400/4160Y
3— 667 KVA Mol 2400-480
3— 500 KVA W-H 33000-2400/4160Y
3— 500 KVA G-E 22000-2300/4000Y
3— 333 KVA G-E 33000-2300/4000Y
3— 333 KVA A-Ch 2400-480
6— 250 KVA W-H 22000-7200/12470Y
3— 200 KVA Penn 33000-480
3— 200 KVA Mol 7200-2400/4160Y
3— 167 KVA W-H 13200-240/480
50— 100 KVA Cent 13800-240/480
50— 50 KVA Cent 13800-120/240

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QU.	KVA	MFGR	VOLTAGE
3	667	Kuhl.	66,000-480
3	200	Pitts.	66,000-2300
3	1500	Wag.	44,000-6900/11950
3	75	West.	44,000-7200/12470Y
3	5000	G.E.	38100/66000-6600
4	3125	Mol.	77000/66000Y-26600/46000Y
3	3333	G. E.	33000/11000-2400/7200
2	3000	Stand.	33000-4160, 3 Ph.
4	1667	West.	34,500-7200, Inertaire
3	1500	A. C.	34,500-2300
3	667	A. C.	33000-2400/4160Y
4	333	Kuhl.	33000-7200/12470Y
3	200	A. C.	34500-2400/7200/12470Y
2	75	Wag.	33000-240/480
1	3000	A. C.	23,380-2500/4330Y, 3 Ph.
3	2000	A. C.	26,400/13,200-2390/4140
3	1000	G. E.	23,310-2500/7500/12990Y
3	100	G. E.	22,000-7200/12470Y
3	50	G. E.	22,000-2300
3	1667	G. E.	13,800-600
1	1000	West.	13,200-2300, 3 Ph. Unit Sub.
1	1000	A. C.	13,800-480, 3 Ph.
1	600	Stand.	13,200-2300, 3 Ph.
1	450	Penna.	13,200-2400, 3 Ph. Askarel
3	200	G. E.	13,200-2400
3	50	West.	13,800-125/250
1	2500	A. C.	11,000-2400/4160Y, 3Ph.
3	125	A. C.	6900-2300
3	500	West.	2400/4160Y-240/480
3	150	West.	2400-230/115
1	100	G. E.	2300-575, 3 Ph.
6	50	West.	2400-114/228, Dry Type

FEEDER REGULATORS—Outdoor

1	500	West.	167 A. 34500 V. 3 Ph. STEP
1	250	A. C.	601 A. 2400 V. 3 Ph. STEP
3	96	G. E.	200/400 A. 2400 V. 1 Ph. IND.
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Advertising in This Issue

Allis-Chalmers Mfg. Co.....4th Cover
6, 7
American Creosoting Corp..... 93
Anaconda Wire & Cable Co..... 15

Baxter & Co., J. H..... 45
Bell Telephone Laboratories 124, 125
Blackburn Corp., Jasper..... 26

Cable Spinning Equipment Co..... 131
Clark Controller Co., The..... 39
Colorado Fuel & Iron Corp.,
Wickwire Spencer Steel Div. .. 30
Combustion Engineering, Inc....8, 9

Delta-Star Electric Division, H. K.
Porter Company, Inc..... 91
Directory of Engineers..... 130

Eastern Specialty Co..... 98
Electrical World 132
Elliott Company 95
Engineers, Directory of..... 130
Esterline-Angus Co., Inc..... 111
Everstick Anchor Co..... 110
Exide Industrial Div., The Electric Storage Battery Co...3rd Cover

General Cable Corp..... 37
General Electric Co.,
Apparatus Dept.....73, 74, 75, 76
78, 79, 81, 82, 83, 117

Hazard Insulated Wire Works, Inc. 4
Hubbard & Co..... 99
Hubbell Inc., Harvey 88

I-T-E Circuit Breaker Co.,
Switchgear Div. 89
Irwin Auger Bit Co..... 118

Johns-Manville 117

Kearney Corp., James R.....102, 103
Kerite Co., The..... 48
Kuhlman Electric Co..... 27

Lapp Insulator Co., Inc..... 14
Line Material Co....31, 32, 33, 34, 35

Micro Balancing, Inc..... 84
Minerallac Electric Co..... 111
Minneapolis-Honeywell Regulator
Co., Industrial Div.....100, 101
Moloney Electric Co.....46, 47

National Electric Coil Co..... 38
National Telephone Supply Co.... 96

Ohio Brass Co.....23, 24
Okonite Co., The 4

Page Fence Assoc. 104
Pennsylvania Transformer Co..12, 13
Penn-Union Electric Corp.....10, 11
Pfaff & Kendall..... 87
Preformed Line Products Co..... 108

R T & E Corp..... 86
Remington Rand Div., Sperry
Rand Corp. 40
Rockbestos Products Corp..... 85
Rome Cable Corp. 121, 123
Royal Electric Mfg. Co., Inc..... 112

Sangamo Electric Co..... 16
Searchlight Section 128, 129
Simplex Wire & Cable Co..... 18
Square D Co..... 17
Standard Transformer Co..... 36

Texas Co., The..... .....2nd Cover
Thomas & Betts Co., The..... 119

Wagner Electric Corp.....28, 29
Walker Div., Norma-Hoffman
Bearings Corp. 92
Warn Mfg. Co..... 104
Westinghouse Electric Corp....41, 42
43, 44, 107
Wickwire Spencer Steel Div., Colorado Fuel & Iron Corp..... 30
Wincharger Corp. 25
Willys Motors, Inc..... 105

■

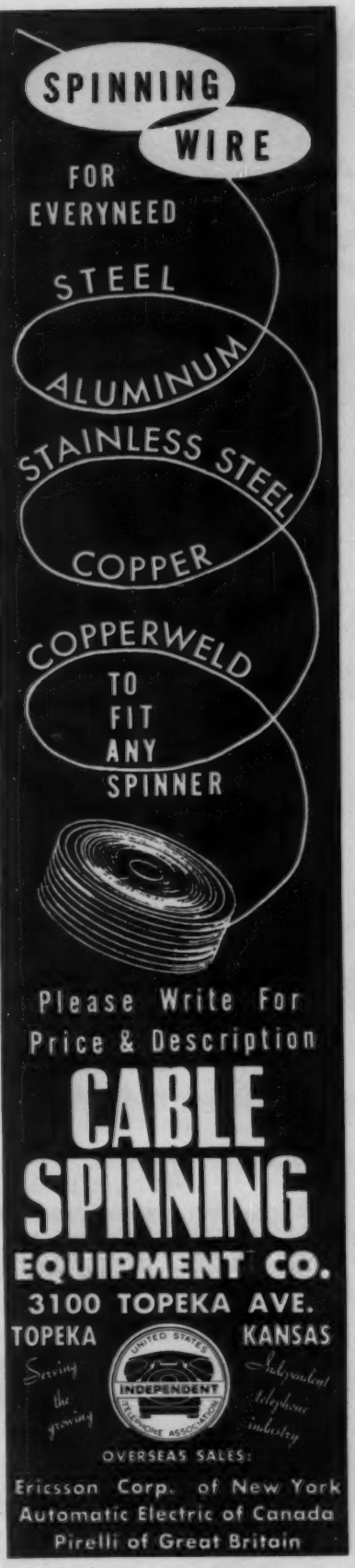
PROFESSIONAL SERVICES 130

■

CLASSIFIED ADVERTISING
F. J. Eberle, Business Mgr.

EMPLOYMENT OPPORTUNITIES.128, 129

EQUIPMENT
(Used or Surplus New)
For Sale 128, 129



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The world of science behind
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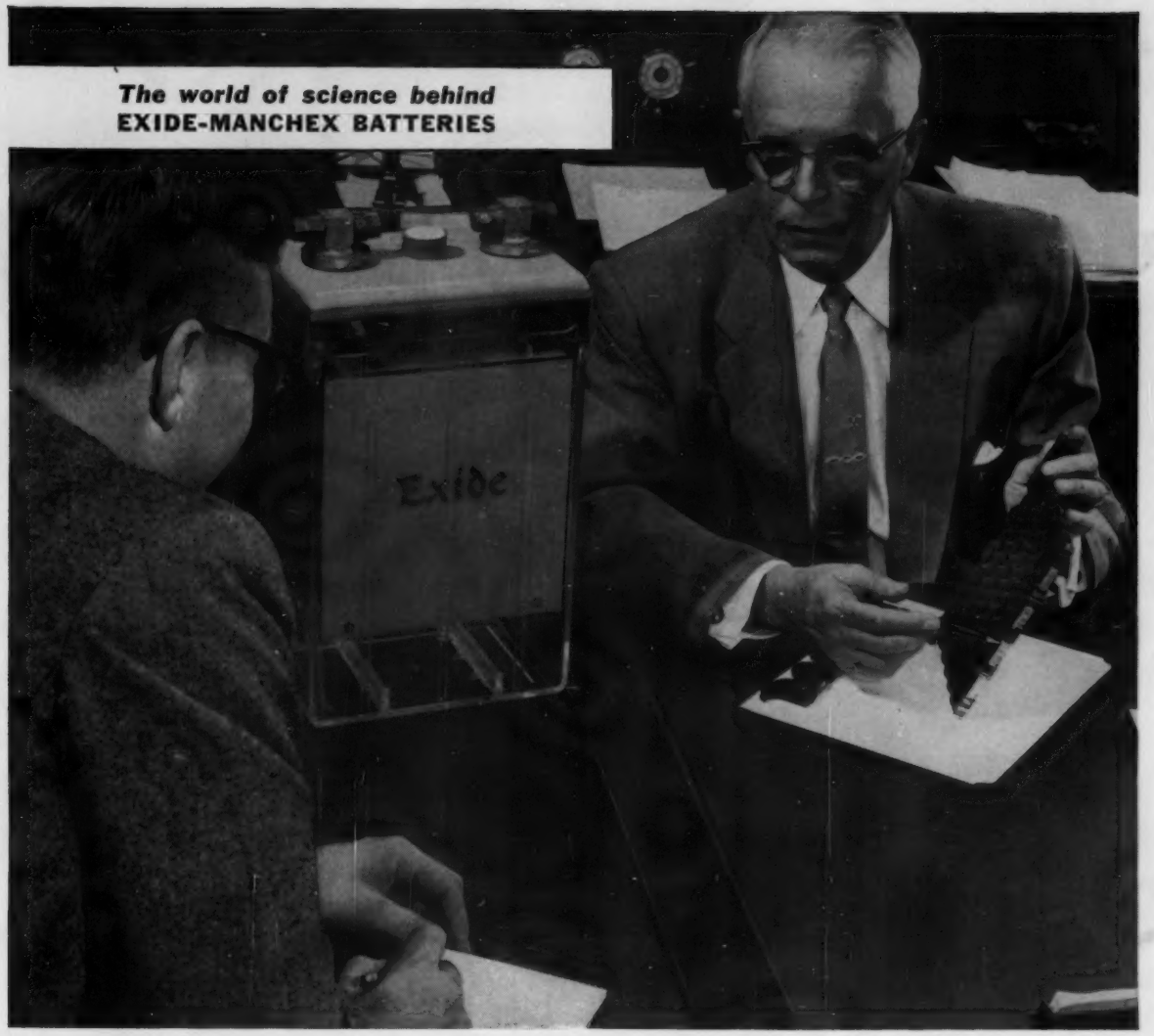
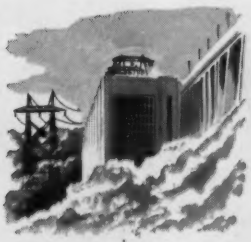


Being interviewed is L. E. Wells, Director of Engineering

"The reserve lead stretches battery life"

At the Exide Laboratories—**Reporter:** You're pointing to the lead buttons in an Exide-Manchex positive plate, aren't you?

Wells: That's right. And only a very small portion of the lead is activated when the battery is made. The rest is left in reserve.



Reporter: Why do you provide this reserve lead?

Wells: To keep the battery young. As long as this reserve is there, an Exide-Manchex Battery works just as well as when it comes from the factory.

Reporter: Is that why the battery lasts so long?

Wells: Yes, and there are Exide-Manchex Batteries in use today over 20 years old with years of life left.

Reporter: Don't other batteries have a reserve lead supply?

Wells: Yes, but the reserve lead must support a plate. When it gets too thin, sometimes the plate disintegrates. The Exide-Manchex buttons are supported by a special grid that doesn't disintegrate. The reserve lead can be completely used without weakening the plate structure.

Reporter: Obviously this is an important feature in the Exide-Manchex Battery.

Wells: Yes it is, but just one of many engineering details that contribute to their long life.

Note to battery users: When you order batteries for float or cycle service in stationary applications, be sure to specify Exide-Manchex. Write for detailed bulletin. Exide Industrial Division, The Electric Storage Battery Co., Philadelphia 2, Pa.

THE ELECTRIC STORAGE BATTERY COMPANY **Exide**®

Compare cost of Regulators and LTC Transformers

Regulators save $4,167

Here's the money-saving way to regulate taking full advantage of *Vari-Amp* on Allis-Chalmers regulators.

1.
Select substation size: In example shown, we used: 3750 kva, 13.2 kv, 164 amps, self-cooled.

2.
Determine percent regulation required. Here's the important step. A careful check will disclose that few systems actually require full ±10% regulation today. In this example +8¾% −7½% is needed.

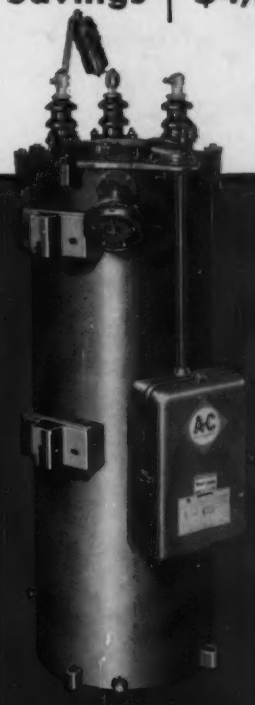
3.
Select proper size regulating unit based on current or kva and range of regulation.
To do this job, set up the no load taps on the transformer (or order an alternate voltage) for a 2½% voltage raise. It is then necessary to get only +6¼% raise from the regulator to obtain the desired 8¾% total raise.

On the buck side, −10% regulation from the regulator will provide the needed −7½% regulation for the system. The +2½% in the transformer algebraically added to −10% provides the −7½% buck.

Since an Allis-Chalmers regulator with *Vari-Amp* providing +6½% −10% regulation costs less than a ±10% unit of any type, you save $4167.00.

Here's a typical cost comparison on a 4330-volt feeder:	
Load tap changing portion of transformer	$9,471
3 single-phase Allis-Chalmers distribution regulators using *Vari-Amp*....	$5,304
Savings	**$4,167**

Get the Key to Low Cost Regulation (No. A-5307) with complete charts and explanation of how to figure savings with *Vari-Amp*. Call your nearby A-C office, or write to Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wisconsin.



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